Gmail

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Douglas Nonattainment Area Revised Regional Conformity

1 message

Fluitt, Allison <Allison.Fluitt@kimley-horn.com> Wed, Apr 17, 2024 at 5:39 AM
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Cc: "Tworek, Robert" <Robert.Tworek@kimley-horn.com>, Beverly Chenausky <bchenausky@azdot.gov>, "Smith, Don" <Don.Smith@stantec.com>, "Fluitt, Allison" <Allison.Fluitt@kimley-horn.com>

Members of the IAC,

We have completed the revised version of the Douglas Nonattainment Area Regional Conformity document. Attached to this email are three files for your reference:

- A fully compiled PDF of the report
- A Word document including tracked changes that reflect the revisions made in the report
- The Excel file tracking IAC edits and responses

Please review the revised report and provide any final comments by April 30. Please include Allison Fluitt, Robert Tworek, Beverly Chenausky, and Don Smith in your responses (all included in the CC line of this email).

Thank you,

Allison

Allison Fluitt, P.E. (NC, MS)**, AICP** | Vice President
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3 attachments

Douglas Nonattainment Area Regional Conformity_04092024.pdf
12182K

Douglas Nonattainment Area Regional Conformity_04092024_track changes.docx
1182K

F0534_Interagency Consultation Comment Form_EPA_Response_To_Resolution_Comments_03072024_KH Tracking.xlsx
147K

ADOT Environmental Planning		Interagency Consultation Comments										
Project Name:		Douglas Commercial International Port of			Name: John Kelly, Lindsay Wickersham, Andrew Ledezma, Karina O'Connor							
Project Number(s):		Federal Project No.: 999-A(561)T			Agency: EPA Region 9							
Document Name:		Douglas Nonattainment Area Regional Con[illegible]										
Document Date:		November 2023				COMMENT RESOLUTION	PRELIMINARY COMMENT RESOLUTION	PRELIMINARY COMMENT RESOLUTION	EPA RESPONSE TO RESOLUTION COMMENTS 2-14-24	FHWA RESPONSE TO RESOLUTION COMMENTS 2-21-24	REVISED COMMENT RESOLUTION	
						For ADOT USE	FOR CONSULTANT USE	FOR CONSULTANT USE			FOR CONSULTANT USE	
Page Number	Addressed?	Paragraph	Table	Other	Comment	Response Notes	Response Notes	Expanded Responses				
1	Yes	5		Section 1.1	Please amend "Boarder" to "Border."		Change made				Comment resolved	
1	Yes	5		Section 1.1	As per 40 CFR 93.119(e)(2), the baseline year for the less than baseline test for [illegible]		To change.	Discussion required			A 1990 baseline pre-analysis consensus memorandum was furnished to ADOT to provide to the IAC on 2/16.	
5	Yes		1	Section 3.1.1	Why does the PM10 MOVES Runspec Parameter - "Time Span" not include weekends? The MOVES4 guidance (page 24) states: "When modeling emissions for a longer time period, e.g., for a multi-day period or an annual inventory, both weekday and weekend day should be checked in the Time Span Panel, and both weekday and weekend day data should be included for the CDM inputs where they can differ (listed above)." Please justify.		The decision to only include weekday was based on a number of reasons. A previous PM10 conformity analysis completed in Arizona that only looked at weekdays was used as a surrogate for this area as there had not been any previous work completed for the nonattainment area. We also identified that the area was originally designated nonattainment for primarily industrial reasons, which have weekday operations. Further, the nonattainment area is in a rural area with very little recreation and reduced levels of weekend traffic, so adding weekends to the analysis would not have a significant impact on the [illegible]		As per our conversation on 2/8/24, we understand that weekends will be added. We appreciate the explanation provided.		Comment resolved	
5	Yes			Section 3.1.2.1	Please indicate which source types were updated with 2008 and 2020 MVD data [illegible]		Source types 11-54 were developed from MVD data. Source types 61 and 62 were [illegible]		[illegible]		Comment resolved	
5	Yes			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		Comment resolved	
6	Yes			[illegible]	[illegible]		[illegible]	[illegible]	[illegible] ...OE at a later date.	We would like to discuss the source type population growth rate assumptions with the interagency group, especially the growth rate used for the combination trucks (61 and 62). (Section 3.1.2.1)	As described in Section 2.3 and Section 3.4.2 of the Final Traffic Report completed in June 2023 for the IPOE Connector Road Design Concept Report, the 1.1% growth rate associated with the IPOE comes from the Douglas Arizona Regional Feasibility Study prepared by Stantec in June 2018, which analyzed historical inbound truck volumes at the existing IPOE between 2011 and 2017 and calculated an average annual growth rate of 1.1%. The proposed new commercial IPOE [illegible]	Question was whether this was related to the vehicle source type population growth. Projections for this type of populations are generally based on overall population or VMT growth. Can a projection be modified to reflect VMT growth or human population growth? This is on top of an existing growth of 2% and is specific to truck population growth. Additional clarification can be provided in the document to add a distinction in the growth rates. This is a conservative approach since we don't know whether engines are starting at the IPOE. Pass-through trucks should not be included in the VMT population. George: breaking out these numbers it looks like truck growth percentage is actually 0.4%. 1.1% is total growth rate inclusive of all vehicles and pedestrians. Lindsay: does it make sense to have a steady growth rate or will it result in an induced demand for truck traffic? George: Does the GSA POE NEPA study provide information on this? [illegible]
7	Yes		Table 4	[illegible]	[illegible]		[illegible]	[illegible] years. The traffic study will be attached as an appendix to the revised report. We will add this and additional information to text.	Thank you for adding this in.		Comment resolved	
7	Yes	3			Please indicate which growth rates were applied to the 2022 VMT and how these numbers were generated. A discussion on how these rates were created, and how they changed the VMT should be included in the report.		A 2% growth rate was applied to the 2022 VMT. Additional VMT was added based on volume information from the traffic study. Will include more information in the text.	For future VMT, a no build scenario was developed for each future analysis year using the 2% growth rate developed in the traffic report. The traffic report has volumes and truck percentages for the connector road and SR 80 for 2028 and 2050. For each build scenario, additional VMT based on the volumes in the traffic report were added to the no build VMT. Additional traffic for years 2035 and 2040 was interpolated from the 2028 and 2050 analysis years. The traffic study will be attached as an appendix to the revised report. We can add additional information and tables to text or include as an appendix.	Thank you for adding this in.		Comment resolved	
7	Yes		Table 4		It would be helpful to see the yearly VMT estimates split out by HPMS Vehicle type. Please consider including this as a table if it is not to cumbersome to [illegible]		We will add to report.		Thank you for adding this in.		Comment resolved	
8	Yes			Section 3.1.2.5	It is not appropriate to use national default data for this MOVES input per section 4.7.1 of the MOVES3 Guidance. We recommend an IAC call to determine the best approach forward for this input. Please see section 3.3.3 for information on how to calculate the Day VMT fraction using the AADVMT Converter for MOVES3. If it is not possible to use this approach, please explain why in the report.		Rephrase the last sentence of section 3.1.2.5. We followed this process with the converter, just need to say it correctly.	The final VMT data developed from local HPMS and MOVES default data was input into the AADVMT converter to develop all VMT fractions. This was incorrectly stated as default data in the report. We will revise the last sentence in this section.	This is great news.		Comment resolved	
8	Yes			Section 3.1.2.7	Which of the 13 source types was the ADOT HPMS Data used for and were any of the local road distributions not available for some of the 13 source types? If so, how was this addressed in accordance with MOVES3 guidance Section 4.7.1?		ADOT HPMS data was available for three vehicle classes: passenger car, single unit trucks, and combination trucks. Road type distributions were developed for these three classes and expanded to all source types as mentioned in the MOVES guidance.	Similar to the discussion of the development of source type and vmt for the nonattainment area, road type distributions were available for Passenger, SU, and CU classes from the ADOT data. According to the MOVES guidance, the distributions for the three ADOT vehicle classes could be used for each source type they represent. Passenger was used for source types 11, 21, 31, and 32. SU was used for 41, 42, 43, 51, 52, 53, and 54. CU was used for 61 and 62. We will provide this explanation in the report.	Thank you.		Comment resolved	
8	Yes			Section 3.1.2.7	Please provide more detail on the future year road type distributions, and how they differ from year to year (if they do). Please expand this section with more detail and description.		Future road type distributions change from year to year based on different traffic patterns with the new POE (i.e., urban vs rural). Will include more information in this section.	Road type volume distributions were adjusted for build scenarios due to the POE volume impacts. 2022 VMT by HPMS type was projected for all no build scenarios by 2%. We obtained 2028 and 2050 volumes for the connector road and SR 80 from the traffic study. The study also assumed 20% of the total volumes was truck traffic. This was used to develop both a truck and passenger car VMT in addition to the no build VMT. The proposed connector road is located in a rural portion of the nonattainment area and will move traffic away from the urban portion of the area. Therefore, there is a higher percentage of VMT on rural roads than urban roads in future years. We will provide this explanation in the report.	Thank you. We look forward to seeing this in the final report.		Comment resolved	
9	Yes			Section 4.1	What were the VMT inputs used for these analyses? Please be more specific and reference the section above if using the same VMT values.		Values used in this section are from the NEI. Will review and revise text as necessary	This section is representative of a literature review of the methodologies for calculating values in the NEI. County-level VMT from FHWA was used to develop emissions in the NEI. All other values referenced and used in Section 4 are from the NEI.	Thank you. Was the county-level data adjusted for the regional analysis in any way?		As noted in the comment below, the proportional population of the non-attainment area in relation to Cochise County as a whole was used as the basis for the adjustment for the NEI data. The population of the nonattainment area was estimated from 2020 census data and was determined to be ~16.93% of the county population. This approach was consistent with that used in sources included in our literature review of methodologies.	
9	Yes			Section 4.1.1	What year of annual unpaved VMT estimates were used? What was the ratio of nonattainment area population to county population that was used? Describe where this ratio came from and how it was calculated.		Values used in this section are from the NEI. Will review and revise text as necessary	This section is representative of a literature review of the methodologies for calculating values in the NEI. The population of the nonattainment area was estimated from 2020 census data and was determined to be ~16.93% of the county population.	Was this the basis of the adjustment to the NEI data? If so, please add the numbers and explanation into the report.		Yes, the proportional population of the non-attainment area in relation to the county as a whole as used as the basis for the adjustment to the NEI data. This approach was consistent with that used in other sources included in our literature review of methodologies.	
10	Yes	1		Section 4.1.2	Control factors must be adopted into the SIP, or be a part of an active MOU. Please either cite the SIP/MOU, or remove the emission adjustment due to vacuum sweeps twice a month. See 40 CFR 93.122(a)(3) and 40 CFR 93.122(a)(4)		There was no emission adjustment in Section 4.1.2.	There was no futher emission adjustment in Section 4.1.2 apart from what is already adjusted in the NEI. Additionally, there is no active SIP for this area. We can remove the discussion of control factors from this section as it is only representative of what is already adjusted in the NEI.	Thank you for deleting the emissions controls language.		Comment resolved	
11	Yes	3		Section 4.1.3	It is stated that construction dust does not have PM10 emissions associated with it for this project, but then emissions from road construction dust are accounted for in Table 5. Please explain this discrepancy.		There is no construction dust for this project as the beginning year for analysis is after the roadway is open for traffic. However, there is regional construction dust that is accounted for in the analysis from the NEI. Will edit text [illegible]		Thank you.		Comment resolved	
11	Yes			Section 4.1.4	It is stated that, "Census track data related to the County and to the nonattainment area was used to proportionately adjust the unpaved, paved and construction dust from the County level to the nonattainment area." Please explain this adjustment in more detail including values of the original vs the [illegible]		Will add further detail and a table	The population of the nonattainment area was estimated from 2020 census data and was determined to be ~16.93% of the county population. The Arizona Department of Administration, Employment and Population Statistics, Office of Economic Opportunity develops population growth estimates for future years at the county level. Based on the growth estimates and the percentage of population in the nonattainment area, future estimates were developed for the nonattainment area. We will add more information and values regarding population growth in the text.	Thank you. We look forward to seeing the further detail and the table in the analysis.		Comment resolved	
12	Yes		5	Section 4.2	Please explain why there is little change in Paved road dust from 2028 to 2050 despite 3x the trucks in 2050 compared to 2028		Will investigate	Road dust estimates for future years were based on estimated population growth and not source type.	Thank you for the explanation. We would like to discuss this assumption. We may agree, but want to hear more about this reasoning.	It is probably not appropriate to scale up the road dust emissions by the county population growth rates; consider using VMT estimates instead. (Section 4.2)	We are amenable to revisiting this assumption to consider growth in source type population or VMT estimates. We will investigate this section further in advance of our IAC call.	EPA concurs with the VMT approach. Clarify that this was done by road type and not just for lane miles for 1990.
12	Yes		5	Section 4.2	It appears that while VMT increases from 2040 to 2050, the unpaved road dust, paved road dust, and road construction dust PM10 emissions decrease? Please [illegible]		Will investigate	A calculation error was found in the growth for 2040. When corrected, the values increase from 2040 to 2050. Will update table.	Thank you for correcting this error. What was the error? How are we assured that this error was isolated?		This error was a typographical error in an exponent. We corrected the error and recalculated the value. This formula did not occur elsewhere; therefore, it is an isolated occurence. We also performed a review of the other calculations to ensure no other calculation errors were present.	
App. A; 4	Yes			Meterology Data	Please indicate what year the meterology data is based on. If older than 5 years, please provide justification for why this is the best available data		As stated in section 3.1.2.3, year 2008 meteorological data from 2008 was used. For all future years, year 2019 data was used as it is the most recent full year of data available from NOAA	Clarification. 2008 met data was used for the 2008 base year. For all future years, the 2019 data was used as it is the most recent available data. This data source was determined to be the best avaialble data through the IAC coordination. The text will be revised to clarify this further.	Looking at currently available NOAA data for the Douglas Bisbee International Airport, we see data for 2023. Can you explain why this data was not used?		We did not use 2023 meteorlogical data for this analysis since this year was incomplete when we performed our analysis (our analysis was done in 2023).	
General										What is the status of the two projects – the port itself as well as the ADOT connector road project? Is there a preferred alternative for the connector road project?	Alternative 1 is the preferred alternative for the Douglas Connector Road. We are attaching the integrated schedule of the POE and the Douglas Connector Road, as well as a map showing the preferred alternative for the Douglas Connector Road. The project is included in ADOT's 5 year plan in the 1st quarter of 2025 (Oct-Dec 2024). Final design complete by end of 2026. 16-month construction period concluding in 2nd quarter of 2028 (Feb-Mar 2028). GSA plans to open the POE to coincide with this date.	
												Construction dust - this is not applicable to the regional conformity. Remove for all analysis year.
												How is the fraction obtained between paved and unpaved road dust? How are we assigning VMT by functional class for paved and unpaved?

Is there a dataset that helps us see the fraction of traffic that travels on unpaved roads vs. paved roads? Beverly says they have a fraction for Pinal County that they could apply to this.

Average weight of 6360 lbs is uniform across all FC, but should be specific to each FC. MOVES can output by road type and can get VMT by soucetype there. MOVES sourceusetype table has vehicle weights. Can calculate average weights by that. Table A1 in MOVES Technical Guidance actually has this informaiton.

Air Quality Regional Conformity Analysis
Paul Spur/Douglas
PM10 Nonattainment Area
Cochise County

Prepared by:

Kimley»Horn

Prepared for:
Arizona Department of Transportation

ADOT

April 2024

TABLE OF CONTENTS

1. INTRODUCTION

As the number of vehicles on the nation's roadways increased in the second half of the 20th century, air pollution from mobile sources was identified as an important national health concern. Recognizing this connection, the 1990 Clean Air Act Amendments (CAAAs) and the Arizona Transportation Conformity Rules require transportation plans, transportation improvement programs (TIP), and projects to conform to the purpose of the Arizona State Implementation Plan (SIP). Conformity to a SIP means that planned transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the national ambient air quality standards (NAAQS). The current federal transportation legislation, the Infrastructure Investment and Jobs Act (IIJA), reinforces the need for coordinated transportation and air quality planning through the metropolitan planning provisions.

The air quality conformity process establishes the connection between transportation planning and emission reductions from transportation sources and is intended to ensure that integrated transportation and air quality planning occurs in areas designated as Nonattainment or Maintenance Areas by the United States Environmental Protection Agency (EPA). A regional emissions analysis must be conducted to assess the impacts that transportation projects will have on emissions within an air quality planning area.

A Nonattainment area is an area that has violated one or more of the National Ambient Air Quality Standards (NAAQS). The Paul Spur/Douglas planning area is currently in nonattainment for large particulates, otherwise known as PM10. This area was designated as a moderate nonattainment area on Oct. 31, 1990 (55 FR 45799). As an isolated rural nonattainment area, the Paul Spur/Douglas planning area is subject to a regional air quality conformity process. Arizona Department of Environmental Quality (ADEQ) is in the process of developing a nonattainment State Implementation Plan (SIP) which will include an emission inventory, modeling demonstration, strategy for Exceptional Events, and requirements for PM10 controls. ADEQ identifies six sources of PM10 for the area – agricultural activities, unpaved roads, cleared areas/vacant lots, open burning and wildfires, windblown dust, and emissions coming across the border from areas outside the U.S. border[1].

The planned Douglas Commercial Port of Entry Connector Road is likely to be classified as regionally significant and is not within a conforming State Improvement Program (SIP). As such, a PM10 regional air quality conformity analysis is required. The purpose of this analysis is to demonstrate that implementation of the project will not worsen PM10 emissions in the Paul Spur/Douglas nonattainment area.

1.1 PM10 Nonattainment Area

The Paul Spur/Douglas PM10 nonattainment area is located along the Mexico-United States Border in Cochise County as shown in **Figure 1**. The Paul Spur/Douglas area is in nonattainment for PM10 particulate matter, which is a mix of solid and liquid droplets 10 microns or less in diameter. The Paul Spur/Douglas area was designated as a nonattainment area under the 1987 24-hour PM10 standard, which was retained under the Environmental Protection Agency's (EPA's) 2006 PM National Ambient Air Quality Standards (NAAQS) review (effective December 18, 2006). The baseline year is defined as the most recent year for which EPA's Air Emissions Reporting Rule requires submission of on-road mobile source emissions inventories as of the effective date of designation, which is 1990 for the 2006 PM NAAQS.

[1] https://azdeq.gov/paul-spurdouglas-pm-10-nonattainment-area

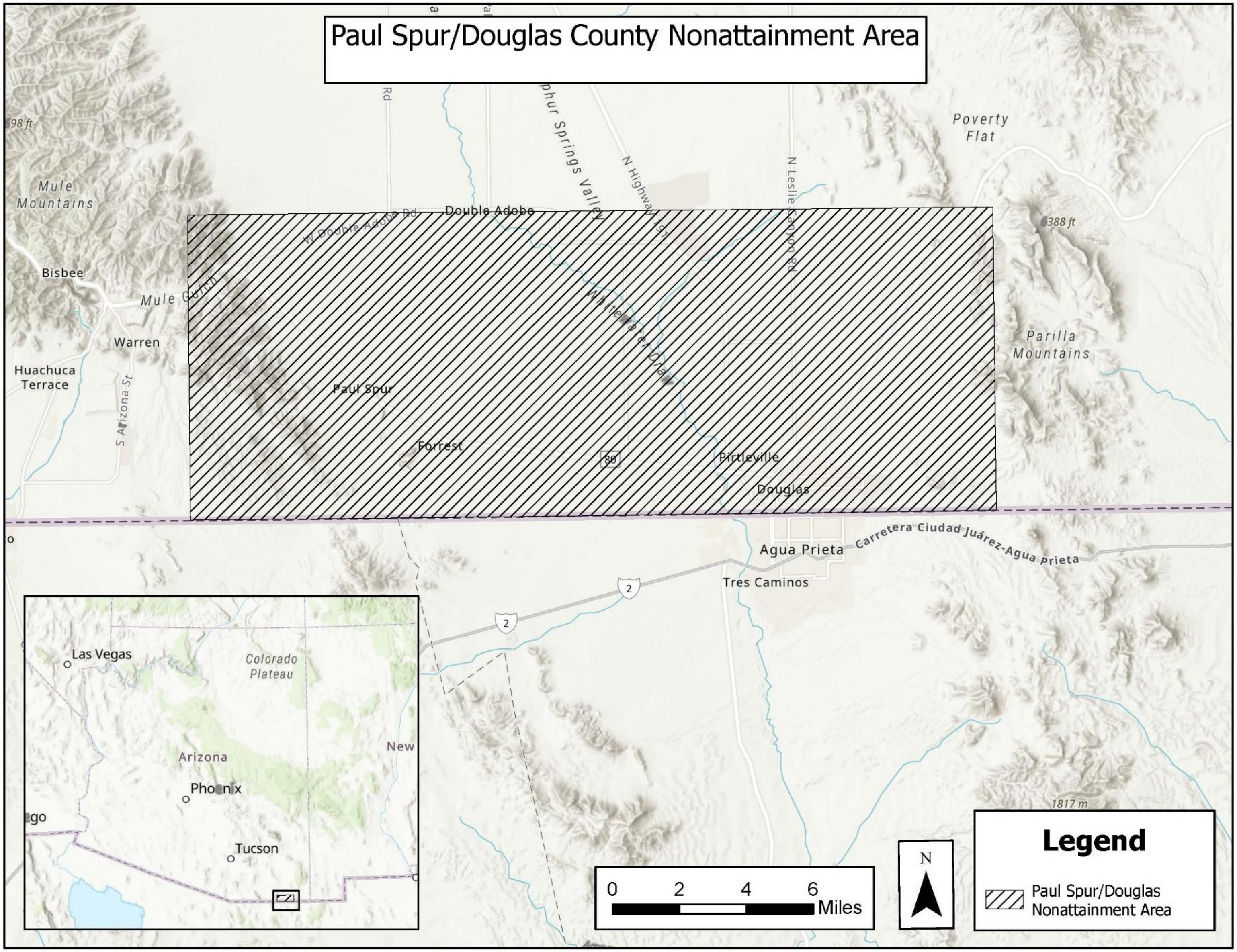

Figure 1. Paul Spur/Douglas Nonattainment Area

2. CONFORMITY OVERVIEW

Regional air quality conformity is most commonly determined by comparing the future year emissions to a motor vehicle emission budget (MVEB) established by the SIP. However, since a SIP has not yet been adopted for this nonattainment area, MVEBs have not yet been established for the area. Therefore, an interim emissions test was performed to demonstrate conformity and meet the air quality requirements for the Paul Spur/Douglas nonattainment area. The no-greater-than-baseline year emissions test was completed to demonstrate regional conformity.

The purpose of this conformity analysis is to demonstrate that the future year "build" emissions are not greater than the emissions from a baseline year for a given standard, referred to as the "no-greater-than-baseline" year, for the Paul Spur/Douglas nonattainment area. If build emissions are found to fall below the baseline emissions, they will not jeopardize the Paul Spur/Douglas region's attainment of the annual NAAQS. The conformity determination has been performed according to procedures prescribed by the following federal, state and local regulations: 69 FR 40004, 40 CFR Parts 51 and 93 (i.e., Transportation Conformity Rule Requirements); Arizona transportation conformity rules; and Planning Assistance and Standards guidance (23 CFR 450) implementing FAST Act and MAP-21 requirements. Results of this conformity determination are found in this report. For this analysis to be found to conform, ADOT must demonstrate that the applicable criteria and procedures have been satisfied (section §93.109-a).

This report documents the process used for the Paul Spur/Douglas regional conformity analysis. EPA's Motor Vehicle Emissions Simulator 3.1 (MOVES3.1[2]) software was used to estimate emissions as required by the EPA[3]. The MOVES input files were created and modified as discussed in the interagency consultation process, with general assumptions and methodology outlined in this chapter. The modeled emissions are based on inputs including temperature, relative humidity, presence of inspection and maintenance programs, vehicle source type mix, vehicle age distribution, average daily vehicle miles traveled (VMT), source type populations, hourly distribution, road type distribution, and average speed distribution.

2.1 Latest Emissions Estimation Model

Mobile source emissions estimates were developed using EPA's Motor Vehicle Emission Simulator, MOVES3.1 (November 2022 Release). According to EPA, MOVES3.1 is a major revision to MOVES2014 and improves upon it in many respects. MOVES3.1 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2014. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES3.1 also adds updated vehicle sales, population, age distribution, and VMT data. In the MOVES3 Mobile Source Emissions Model Questions and Answers[4] the EPA states that for on-road emissions, MOVES3.1 updated heavy-duty (HD) diesel and compressed natural gas (CNG) emission running rates and updated HD gasoline emission rates. MOVES3.1 updated light-duty (LD) emission rates for hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxide (NOx) and updated light-duty (LD) particulate matter rates, incorporating new data on Gasoline Direct Injection (GDI) vehicles.

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[2] https://www.epa.gov/moves/moves-versions-limited-current-use

[3] MOVES3 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity, November 2020.

[4] EPA Releases MOVES3 Mobile Source Emissions Model - Questions and Answers (EPA-420-F-20-050), November 2020.

EPA approved MOVES4 in September 2023 with a two-year grace period extending until September 2025. This analysis was initiated prior to the release of MOVES4. Therefore, this regional conformity analysis was conducted using MOVES3.1.

2.2 Interagency Consultation and Public Participation

Interagency consultation (IAC) is the central coordinating mechanism for public agency involvement and input to the conformity determination. The conformity determination must be made according to 40 CFR §93.105-(a)-(2) and (e) and the requirements of 23 CFR 450 (40 CFR §93.112, Criteria and Procedures).

ADOT coordinated its activities for this conformity determination with numerous stakeholders and review agencies, including ADEQ, FHWA, EPA, local jurisdictions, and other necessary agencies. ADOT held teleconference calls and email correspondence to discuss the issues pertinent to the Paul Spur/Douglas Regional Conformity Demonstration, such as use of the latest planning assumptions. The meetings that were held and scheduled are listed below:

- IAC Kick-Off Meeting – May 8, 2023
- IAC Methodology Meeting – June 22, 2023
- IAC Methodology Meeting – August 21, 2023
- IAC Report Review –December 7, 2023
- IAC Updated Base Year Methodology Meeting – March 15, 2024

2.3 Conformity Test

The conformity tests specified in the federal transportation conformity rule are: (1) the emissions budget test, and (2) the interim emissions test. For the emissions budget test, predicted emissions for the TIP/RTP must be less than or equal to the motor vehicle emissions budget (MVEB) specified in the approved air quality implementation plan or the emissions budget found to be adequate for transportation conformity purposes. If there is no approved air quality plan for a pollutant for which the region is in nonattainment or no emission budget has been found to be adequate for transportation conformity purposes, the interim emissions reduction test applies.

Since a budget has not been established for the Paul/Spur Douglas area the interim emission reduction test, known as the no-greater-than-baseline test, was applied. The baseline year is defined as the most recent year for which EPA’s Air Emissions Reporting Rule requires submission of on-road mobile source emissions inventories as of the effective date of designation, which is 1990 for the 2006 PM10 NAAQS.

3. METHODOLOGY

The emissions inventory development and emissions projection discussion below identify procedures used by the ADOT to obtain emissions for the PM10 nonattainment area. Pre-consensus memoranda were developed for the 1990 base year and future analysis years and discussed during the interagency consultation coordination outlining the model assumptions and data sources. A copy of the updated pre-consensus memoranda can be found in **Appendix A**. The pre-consensus memoranda outline the approach taken for data sources for the conformity demonstration.

3.1 Mobile Source Emissions

3.1.1 Runspec Parameters

Table 1 summarizes the settings used in the MOVES run specification file for PM10, respectively.

Table 1 – PM10 MOVES Runspec Parameters	
MOVES Runspec Parameter	**Settings**
MOVES3.1 Version	Database version 2022/10/07
Scale	County, Inventory
Time Span	Years: 2008, 2028, 2035, 2040, and 2050 Time aggregation: Hour All Months All hours of the day selected Weekdays and Weekends
Geographic Bounds	Arizona – Cochise County
Vehicles/Equipment	All available fuel types All available source types
Road Type	All road types including off-network
Pollutants and Processes	Pollutants: PM10 and any additional pre-requisites All Processes
General Output	Units: grams, joules, miles Activity: Distance Traveled, Population
Output Emissions	Time = hour, location = county
Advanced Features	None

3.1.2 County Data Manager

Once all of the base parameters have been established for a given MOVES Runspec, the County Data Manager can be used to enter locally-specific data. Input provided in Excel spreadsheet format can be referenced using this tool, which converts the data to MySQL format and incorporates it into the MOVES analysis. For this analysis, locally-specific data could consist of data used for the entire region, statewide, or county-level data. Default data refers to data extracted from the most up to date available MOVES program (MOVES3.1) for each scenario being modeled. The methodology used for each input contained within the MOVES County Data Manager is detailed below.

3.1.2.1 Vehicle Type VMT

Source Type (vehicle type) Population and Vehicle Type VMT were developed as part of the same procedure using a combination of data from Arizona Motor Vehicle Division (MVD) reports, default MOVES data, and ADOT HPMS VMT data. The process began with the development of a source type population and VMT at the county level, and then using the county data to develop estimates for the nonattainment area.

Default VMT and source type population for Cochise County were obtained from MOVES for 1990 and 2022. Local Cochise County source type population was gathered from MVD reports for January 2003 and January 2020. The MVD reports and a MOVES converter tool were provided by ADOT. ADOT's MOVES converter tool can convert different data, including MVD reports, into MOVES-ready input files. The 2003 data was extrapolated to

1990 based on overall County population estimates to develop a local source type population for 1990. The 2020 data was used as a conservative estimate for 2022 as the County population decreased slightly by 1.4%. Cochise County population estimates from the U.S. Census are provided in **Table 2**.

Table 2 – U.S. Census Population Estimates for Cochise County			
1990	**2003**	**2020**	**2022**
97,624	120,638	127,450	125,663

Local County VMT by source type was not available. However, according to MOVES technical guidance[5], it is possible to calculate the local VMT or source type population by using the following ratio:

$$\frac{Local\ VMT}{Local\ Population} = \frac{Default\ VMT}{Default\ Population}$$

This resulted in the estimated Cochise County VMT by source type for 1990 and 2022 as seen in **Table 3** and **Table 4**, respectively.

Table 3 – Default and Local 1990 Cochise County Source Type and VMT				
Source Type ID	Default Data (from MOVES)		Local County Data	
	VMT	Source Type Population	VMT (Calculated)	Source Type Population (ADOT MVD Reports)
11	16,190	1,857	20,862	2,393
21	1,907,462	65,164	1,718,533	58,710
31	583,421	17,968	751,060	23,131
32	61,769	1,875	89,218	2,708
41	8,357	97	7,505	88
42	2,202	26	2,167	25
43	5,910	191	5,370	173
51	2,947	33	1,250	14
52	96,596	1,952	43,786	885
53	7,926	84	3,675	39
54	9,724	494	2,972	151
61	77,412	676	22,050	193
62	163,180	531	54,360	177

[5] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LY2.pdf

Table 4 – Default and Local 2022 Cochise County Source Type and VMT				
Source Type ID	Default Data (from MOVES)		Local County Data	
	VMT	Source Type Population	VMT (Calculated)	Source Type Population (ADOT MVD Reports)
11	30,199	4,610	43,152	6,588
21	1,647,734	52,576	2,890,731	92,238
31	2,271,265	66,513	1,204,123	35,262
32	244,375	6,941	145,362	4,129
41	16,375	198	16,720	203
42	5,252	61	5,699	66
43	8,593	298	8,290	288
51	1,867	37	627	12
52	192,281	5,241	63,680	1,736
53	12,573	226	4,259	77
54	7,452	546	2,352	172
61	75,617	732	22,932	222
62	383,951	1,592	88,811	368

Additional local County-level VMT was available through ADOT HPMS data. This data is broken down into three (3) categories: all vehicles, single unit, and combination unit trucks. A passenger vehicles category was also developed by subtracting the single and combination unit VMT from the total VMT. HPMS daily VMT (DVMT) data for the three vehicle categories for both the County and nonattainment area was obtained for the years 2013 and 2022. ADOT does not have reliable HPMS data for the year 1990. The earliest VMT data available through ADOT is from 2007, but only includes Average Annual Daily Traffic (AADT) for interstates, US routes, and state routes. 2013 AADT data is available for additional roads and is the oldest data set that can be reliably used to develop VMT for the County and nonattainment area. This data is only collected on paved roads that are classified as collector and above, so it is understood that it does not account for the total VMT in the county. The total estimated county VMT by functional class for 2022 was obtained from ADOT's Extent and Travel Reports[6], as well as historical DVMT data by county for 1990 and 2013. HPMS VMT for the County and nonattainment area is summarized in **Table 5-Table** *7*.

Table 5 – ADOT HPMS VMT Data by Vehicle Category			
Year	**Category**	**Cochise County VMT**	**Nonattainment Area VMT**
2013	Passenger Vehicles	2,532,647	213,063
	Single-Unit Trucks	128,399	5,824
	Combination-Unit Trucks	639,647	7,589
	Total	**3,300,692**	**226,477**
2022	Passenger Vehicles	3,388,981	257,327
	Single-Unit Trucks	229,151	14,505
	Combination-Unit Trucks	677,979	8,824

[6] https://experience.arcgis.com/experience/ac0948fc05224aa8a80313f59a634fde?org=adot

	Total	4,296,111	280,656

Table 6 – ADOT 2022 HPMS VMT for Cochise County by Functional Class[6]

Functional Class ID	Functional Class	VMT (known counts)	Total Estimated VMT
1	Interstate	1,690,265	1,822,873
3	PA – Other	652,200	652,201
4	Minor Arterial	1,030,114	1,038,339
5	Major Collector	448,805	453,062
6	Minor Collector	148,917	182,701
7	Local	5,583	1,638,426
Total		**3,975,884**	**5,787,602**

Table 7 – ADOT Historical HPMS DVMT for Cochise County

Year	DVMT
1990	**3,395,000**
2013	**3,673,000**

To determine cumulative VMT estimates by vehicle category, the ratio of the total County HPMS VMT from **Table 7** to the total DVMT (for 2013) and total estimated VMT by functional class (for 2022) was used to scale the VMT of each vehicle category. Then, the percentage of 1990 DVMT to 2013 DVMT (92.4%) was used to determine the estimated VMT breakdown by vehicle category for 1990. The same factors were used to scale the nonattainment area VMT. Final VMT by vehicle category for 1990 and 2022 is displayed in **Table 8**.

Table 8 – ADOT HPMS VMT Data by Vehicle Category

Year	Category	Cochise County VMT	Nonattainment Area VMT
1990	Passenger Vehicles	2,605,010	243,871
	Single-Unit Trucks	132,067	6,666
	Combination-Unit Trucks	657,923	8,686
	Total	**3,395,000**	**259,223**
2022	Passenger Vehicles	4,565,541	346,663
	Single-Unit Trucks	308,706	19,541
	Combination-Unit Trucks	913,355	11,888
	Total	**5,787,602**	**378,092**

This VMT data was then allocated to the 13 MOVES source types through a mapping process to determine the final VMT for Cochise County. The process uses distributions from the local County VMT from **Table 3** and **Table 4** for each of the ADOT vehicle categories to allocate VMT to each MOVES source type. The same distributions are then used to allocate VMT for the nonattainment area. A breakdown of the distributions (rounded to two decimals in the table) is shown below in **Table 9** with the final VMT by source type for Cochise County and the nonattainment area shown in **Table 10**.

Table 9 – VMT Distributions						
ADOT Vehicle Category	Source Type ID	Source Type	Initial 1990 VMT	1990 VMT Distribution	Initial 2022 VMT	2022 VMT Distribution
Passenger Vehicles	11	Motorcycle	20,862	0.81%	43,152	1.01%
	21	Passenger Car	1,718,533	66.62%	2,890,731	67.49%
	31	Passenger Truck	751,060	29.11%	1,204,123	28.11%
	32	Light Commercial Truck	89,218	3.46%	145,362	3.39%
Passenger Total			**2,579,672**	**100%**	**4,283,368**	**100%**
Single-Unit Trucks	41	Intercity Bus	7,505	11.25%	16,720	16.45%
	42	Transit Bus	2,167	3.25%	5,699	5.61%
	43	School Bus	5,370	8.05%	8,290	8.16%
	51	Refuse Truck	1,250	1.87%	627	0.62%
	52	Single Unit Short-haul Truck	43,786	65.62%	63,680	62.66%
	53	Single Unit Long-haul Truck	3,675	5.51%	4,259	4.19%
	54	Motor Home	2,972	4.45%	2,352	2.31%
Single-Unit Total			**66,725**	**100%**	**101,627**	**100%**
Combination -Unit Trucks	61	Combination Short-haul Truck	22,050	28.86%	22,932	20.52%
	62	Combination Long-haul Truck	54,360	71.14%	88,811	79.48%
Combination-Unit Total			**76,409**	**100%**	**111,743**	**100%**

Table 10 – Final 1990 and 2022 VMT for Cochise County and the Nonattainment Area				
Source Type ID	**Cochise County**		**Nonattainment Area**	
	1990 VMT	**2022 VMT**	**1990 VMT**	**2022 VMT**
11	21,067	45,995	1,972	3,492
21	1,735,412	3,081,162	162,462	233,954
31	758,436	1,283,446	71,002	97,453
32	90,094	154,938	8,434	11,764
41	14,854	50,790	750	3,215
42	4,290	17,311	217	1,096
43	10,628	25,183	536	1,594
51	2,474	1,905	125	121
52	86,666	193,436	4,374	12,244
53	7,275	12,938	367	819
54	5,882	7,143	297	452
61	189,859	187,437	2,507	2,440
62	468,064	725,918	6,180	9,448

MOVES requires VMT to be in input by HPMS vehicle type. The mapping of MOVES source type to HPMS vehicle type is shown in **Table 11**, with the 1990 and 2022 VMT for the nonattainment area aggregated in **Table 12.**

Table 11 - Source Type and HPMS Vehicle Type

Source Type ID	Source Type	HPMS Vehicle Type ID	HPMS Vehicle Types
11	Motorcycle	10	Motorcycles
21	Passenger Car	25	Light Duty Vehicles
31	Passenger Truck		
32	Light Commercial Truck		
41	Intercity Bus	40	Buses
42	Transit Bus		
43	School Bus		
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck		
53	Single Unit Long-haul Truck		
54	Motor Home		
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck		

Table 12 – Daily VMT for the Nonattainment Area by HPMS Vehicle Type

HPMS Vehicle Type ID	Analysis Year	
	1990	**2022**
10	1,972	3,492
25	241,898	343,171
40	1,503	5,905
50	5,163	13,636
60	8,686	11,888
Total DVMT	**259,223**	**378,092**

Future year VMT was developed by first creating a no-build scenario for each analysis year that only contained background VMT growth for the nonattainment area. Background VMT growth was obtained by applying a 2% annual growth rate to the 2022 VMT. This growth rate was determined to be representative of the nonattainment area based information contained in the City of Douglas International Port of Entry Connector Road Final Traffic Report, attached as **Appendix B**. Next, a build scenario was developed for each analysis year to account for additional VMT growth expected due to the Port of Entry Connector Road and adjacent land uses. The Traffic Report contained traffic volumes and truck percentages for the Connector Road and SR 80 for years 2028 and 2050. Additional traffic for years 2035 and 2040 was interpolated from the 2028 and 2050 analysis years. For each build scenario, additional VMT based on the traffic volumes and truck percentages from the Traffic Report was added to the VMT in the no-build scenario. **Table 13** displays the total DVMT by HPMS vehicle type for each no-build and build scenario.

Table 13 – No-Build and Build Scenario Daily VMT for the Nonattainment Area by HPMS Vehicle Type for Each Analysis Year								
HPMS Vehicle Type ID	**2028**		**2035**		**2040**		**2050**	
	No-Build	**Build**	**No-Build**	**Build**	**No-Build**	**Build**	**No-Build**	**Build**
10	3,933	4,354	4,518	5,216	4,988	5,884	6,080	7,372
25	386,466	427,861	443,928	512,529	490,132	578,167	597,469	724,369
40	6,650	8,614	7,638	10,893	8,434	12,611	10,280	16,302
50	15,356	19,892	17,640	25,156	19,476	29,122	23,741	37,645
60	13,388	18,884	15,378	25,000	16,979	28,629	20,697	36,435
Total DVMT	**425,793**	**479,605**	**489,103**	**578,795**	**540,009**	**654,412**	**658,268**	**822,123**

MOVES requires the HPMS VMT input to be a yearly VMT value. EPA's AADVMT Converter tool was used to convert daily VMT to yearly VMT for each analysis year. **Table 14** summarizes the Yearly VMT for PM10 by HPMS vehicle type and analysis year.

Table 14 – Yearly VMT by Analysis Year and Nonattainment Area					
HPMS Vehicle Type ID	**Analysis Year VMT**				
	1990	**2028**	**2035**	**2040**	**2050**
10	677,284	1,495,307	1,791,210	2,020,603	2,531,558
25	82,829,950	146,506,435	175,498,252	197,973,603	248,035,720
40	514,553	2,949,517	3,730,089	4,318,043	5,581,900
50	1,768,037	6,811,380	8,613,970	9,971,744	12,890,396
60	2,974,360	6,466,080	8,560,362	9,803,151	12,475,947
Total Yearly VMT	**88,764,185**	**164,228,718**	**198,193,882**	**224,087,142**	**281,515,520**

3.1.2.2 Source Type Population

As discussed briefly in the previous section, MOVES divides the vehicle population into 13 vehicle types to calculate start and evaporative emissions. 2003 and 2020 source type population information for Cochise County was obtained from MVD reports, provided by ADOT, and ADOT's MOVES Converter tool. The 2003 data was extrapolated to 1990 based on overall County population estimates to develop a local source type population for 1990. The 2020 data was used as a conservative estimate for 2022. Default source type for both 1990 and 2022 was also obtained from MOVES. **Table 15** recaps the source type information provided in **Table 3** and **Table 4** in **Section 3.1.2.1**.

Table 15 – Default and Local 1990 and 2022 Cochise County Source Type Population					
Source Type ID	**Source Type**	**1990**		**2022**	
		Default Source Type Population	**MVD Source Type Population**	**Default Source Type Population**	**MVD Source Type Population**
11	Motorcycle	1,857	2,393	4,610	6,588
21	Passenger Car	65,164	58,710	52,576	92,238
31	Passenger Truck	17,968	23,131	66,513	35,262
32	Light Commercial Truck	1,875	2,708	6,941	4,129
41	Intercity Bus	97	88	198	203
42	Transit Bus	26	25	61	66
43	School Bus	191	173	298	288
51	Refuse Truck	33	14	37	12
52	Single Unit Short-haul Truck	1,952	885	5,241	1,736
53	Single Unit Long-haul Truck	84	39	226	77
54	Motor Home	494	151	546	172
61	Combination Short-haul Truck	676	193	732	222
62	Combination Long-haul Truck	531	177	1,592	368
Total		**90,949**	**88,687**	**139,571**	**141,360**

The source type population data from the MVD reports had a limited amount of vehicles for source types 61 and 62, so the default population from MOVES was used for these source types. Therefore, the final Cochise County source type population was a combination of MVD data (source types 11 - 54) and default MOVES data (source types 61 and 62), as seen in **Table 16**.

Table 16 – Final Base Cochise County Source Type Population			
Source Type ID	**Data Year**		**Source**
	1990	**2022**	
11	2,393	6,588	MVD Report
21	58,710	92,238	MVD Report
31	23,131	35,262	MVD Report
32	2,708	4,129	MVD Report
41	88	203	MVD Report
42	25	66	MVD Report
43	173	288	MVD Report
51	14	12	MVD Report
52	885	1,736	MVD Report
53	39	77	MVD Report
54	151	172	MVD Report
61	676	732	MOVES Default
62	531	1,592	MOVES Default

Source type population for the County was adjusted to the nonattainment area using a ratio proportionate to HPMS VMT for the County and nonattainment area for both 1990 and 2022. For 1990, the percentage of nonattainment area VMT (259,223) to Cochise County VMT (3,395,000) was determined to be 7.64%. For 2022, the percentage of nonattainment area VMT (378,092) to Cochise County VMT (5,787,602) was determined to be 6.53%. Applying these percentages to the County source type populations resulted in the nonattainment area source type populations shown below in **Table 17**.

Table 17 – Base Nonattainment Area Source Type Population

Source Type ID	Data Year	
	1990	2022
11	224	501
21	5,496	7,004
31	2,165	2,678
32	254	314
41	4	13
42	1	5
43	9	19
51	1	1
52	45	110
53	2	5
54	8	11
61	9	10
62	7	21

This initial population contained a low level of long-haul combination trucks (source types 61 and 62) relative to the amount of DVMT shown in **Table 13**. Therefore, source types 61 and 62 were adjusted in both the 1990 base year and all future analysis years to account for the commercial vehicles using the Port of Entry. Appendix 1 of the Traffic Report (**Appendix B**) contains excerpts from the Douglas Arizona Regional Feasibility Study completed by Stantec in 2018. Figure J from this study contains inbound commercial vehicle (COV) trends for the years 1996 to 2017 and is shown below as **Error! Reference source not found.**. The trend line from this chart results in an estimated yearly inbound commercial truck volume of about 32,800 for inbound vehicles (Mexico to the U.S.). This appears to be a conservative estimate for 1990 as all years prior to the year 2001 are all well above the trend line. Assuming the commercial vehicle processing is open 5 days a week for 9 hours each day and the outbound demand is equal to the total inbound trucks results in about 252 trucks per day using the existing Port of Entry in 1990. These additional trucks were added proportionally to source types 61 and 62 based on the distribution of combination-unit trucks from **Table 9**.

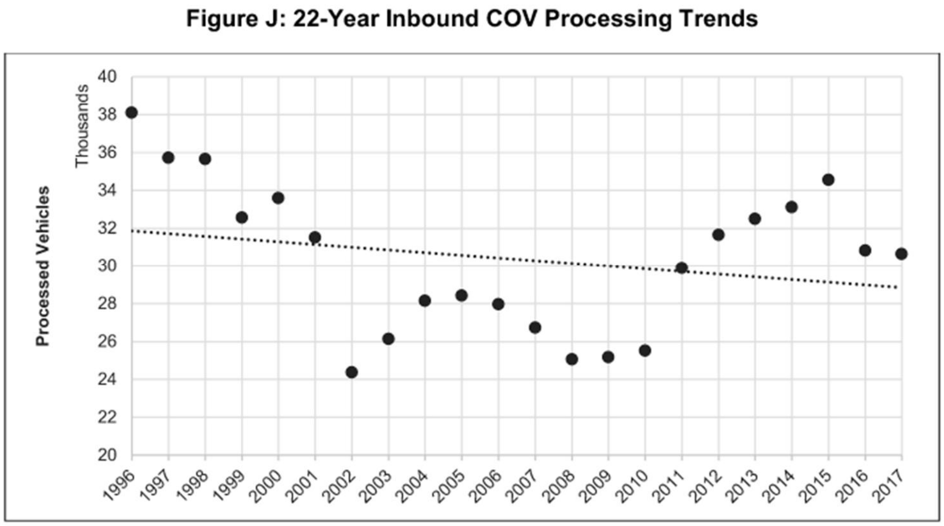

Figure 2: Figure J from the Douglas Arizona Regional Feasibility Study

To determine source type population estimates for future analysis years, no-build and build scenarios were developed for each year similar to the development of future VMT. The same 2% annual growth rate was used to develop background source type estimates for each no-build scenario as was used for VMT. In addition to the background growth, additional truck growth is expected at the proposed Commercial Port of Entry. The Traffic Report states that the hourly truck demand at the proposed Commercial Port of Entry in the opening year of 2028 will be 31 trucks per hour, for a total daily bi-directional demand of 496 trucks per day. These 496 trucks were added proportionally to the no-build populations for source types 61 and 62 to obtain a build 2028 source type population. In addition, an annual growth rate for trucks of 1.1% is expected at the proposed Port beyond the opening year. This additional growth was added to source types 61 and 62 for the remaining analysis years. **Table 18** displays the source type population for each no-build and build scenario. The final nonattainment area source type population by analysis year is shown in **Table 19**.

Table 18 – No-Build and Build Scenario Source Type Population for the Nonattainment Area for Each Analysis Year

Source Type ID	2028		2035		2040		2050	
	No-Build	Build	No-Build	Build	No-Build	Build	No-Build	Build
11	564	564	648	648	716	716	872	872
21	7,888	7,888	9,060	9,060	10,003	10,003	12,194	12,194
31	3,016	3,016	3,464	3,464	3,825	3,825	4,662	4,662
32	354	354	406	406	448	448	547	547
41	15	15	17	17	19	19	23	23
42	6	6	6	6	7	7	9	9
43	21	21	25	25	27	27	33	33
51	1	1	1	1	1	1	2	2
52	124	124	142	142	157	157	192	192
53	6	6	6	6	7	7	9	9
54	12	12	14	14	16	16	19	19
61	11	113	13	131	14	139	17	156
62	24	418	27	483	34	511	37	573

Table 19 – Final Nonattainment Area Source Type Population by Analysis Year					
Source Type ID	**Analysis Year**				
	1990	**2028**	**2035**	**2040**	**2050**
11	224	564	648	716	872
21	5,496	7,888	9,060	10,003	12,194
31	2,165	3,016	3,464	3,825	4,662
32	254	354	406	448	547
41	4	15	17	19	23
42	1	6	6	7	9
43	9	21	25	27	33
51	1	1	1	1	2
52	45	124	142	157	192
53	2	6	6	7	9
54	8	12	14	16	19
61	82	113	131	139	156
62	187	418	483	511	573

3.1.2.3 Age Distribution

MOVES requires each of the 13 source types (vehicle types) to have an age distribution to break down the population from new vehicles to 30+ year-old vehicles. January 2003 and January 2020 vehicle registration data for Cochise County were obtained from Motor Vehicle Division (MVD) reports, furnished by ADOT. Due to the lack of more historical data, the January 2003 registration data was used as a proxy to develop the age distribution for the 1990 analysis year. EPA's age distribution forecasting tool was used to create age distribution files for each future analysis year from the 2020 age distribution.

3.1.2.4 Meteorology

MOVES requires temperature and relative humidity information to calculate emissions rates. Local meteorological data for all months was obtained from the National Centers for Environmental Information (NCEI) website developed by the National Oceanic and Atmospheric Administration (NOAA). Meteorological information collected at the Douglas-Bisbee International Airport was selected based on available data. Historical meteorological data from 1990 was used for the 1990 analysis year. The most recent full year of data at the airport at the time of the analysis was found to be 2019 and was used for all future analysis years.

3.1.2.5 Monthly/Daily/Hourly VMT Fractions

Vehicle speeds and volumes vary depending on the time of day, type of day, and time of year. Monthly, daily, and hourly VMT fractions are required by MOVES to break down the yearly Vehicle Type VMT input file to various time periods. Locally available data sources do not provide information that allows for the generation of VMT by month, day, or time of day. Discussions with ADOT considered surrogate data sources elsewhere in the state but determined that these sources were not of sufficient quality to use for the Paul Spur/Douglas nonattainment area. As a result, the final VMT data for each analysis year was input into EPA's AADVMT Converter tool to develop the monthly, daily, and hourly VMT fractional distributions by roadway type and vehicle type.

3.1.2.6 Average Speed Distribution

MOVES separates vehicle speed information into 16 average speed bins by road type, source type, and hour of the day. Each bin represents a five (5) mile per hour (mph) range of speeds. MOVES uses average speed distribution information to calculate operating mode distributions and determine emission rates. Detailed speed data is not available at a regional or state level so default speed data from MOVES for Cochise County was used for all analysis years.

3.1.2.7 Road Type Distribution

VMT distributions vary between different road types, which impacts the level of emissions from vehicles on each facility. MOVES recognizes five (5) roadway types: Off-Network (related to parking and refueling vehicles), Rural Restricted Access, Rural Unrestricted Access, Urban Restricted Access, and Urban Unrestricted Access. MOVES requires a VMT fraction for each of the roadway types by source type. ADOT HPMS data was used to determine the most current road type distribution for year 2022 for the nonattainment area. ADOT HPMS VMT data was provided for three vehicle classes: passenger, single unit, and combination unit. Road type distributions for each of the three vehicle classes were used for each source type they represent. The road type distribution for the passenger class was used for source types 11, 21, 31, and 32. The road type distribution for the single unit class was used for source types 41, 42, 43, 51, 52, and 53. The road type distribution for the combination unit class was used for source types 61 and 62. Detailed historical data was not available for 1990. As in the discussion of Vehicle Type VMT, 2013 is the earliest year with reliable VMT data. During Interagency Consultation, it was also agreed that the 2013 road type distribution would be representative of 1990 conditions. Therefore, the distribution from 2013 was used for the 1990 analysis year.

2022 VMT by HPMS type was projected for all no-build scenario analysis years by the same 2% growth rate mentioned previously. Road type volume distributions were adjusted for the build scenarios based on the volume impacts associated with the Port of Entry contained in the Final Traffic Report and mentioned previously in **Section 3.1.2.4**. The proposed Connector Road is located in a rural portion of the nonattainment area and will move traffic away from the urban portion of the area. Therefore, there is a higher percentage of VMT on rural roads than urban roads in future years. Due to the changes in vehicle patterns in future analysis years, a different road type distribution was developed for each year.

3.1.2.8 Fuel

In MOVES, fuel information is broken down into four inputs: Fuel Supply, Fuel Formulation, Fuel Usage Fraction, and AVFT (fuel type and vehicle technology). There is no locally available fuels data for the Paul Spur/Douglas nonattainment area. Default fuel data from MOVES for Cochise County was used.

3.1.2.9 Inspection/Maintenance (I/M) Program

No inspection/maintenance programs exist in the nonattainment area of Cochise County. This is assumed to continue in the future.

3.1.2.10 Starts

Starts is an optional input that is only used if local information is available for vehicle start activity. No local data is available, so this input was not used. When no local information is provided, MOVES calculates start activity based on source type population and default vehicle activity assumptions.

3.1.2.11 Hoteling

Hoteling is an optional input that is only used if local information is available for long-haul combination truck hoteling activity. No local data is available, so this input was not used. When no local information is provided, MOVES calculates hoteling activity based on long-haul combination truck VMT on restricted access roads.

3.1.2.12 Idle

Idle is an optional input that is only used if local information is available for off-network idle activity. This off-network idle is not related to combination truck hoteling activity. No local data is available, so this input was not used. When no local information is provided, MOVES default information is used.

3.1.2.13 Retrofit Data

Retrofit Data is an optional input that is only used if there are local heavy-duty diesel retrofit and/or replacement programs in use. No retrofit programs currently exist in the nonattainment area and this is assumed to continue in the future.

4. PM10 ANALYSIS

The following sections outline the analysis components and results of the PM10 conformity demonstration.

4.1 Paved and Unpaved Road Dust

The primary contributor to PM10 emissions in the Paul Spur/Douglas - area is road dust from paved and unpaved roads. Emissions for road dust are calculated using the AP-42[8]. The *AP-42, Compilation of Air Pollutant Emission Factors*, has been published since 1972 as the primary compilation of EPA's emission factor information. This document, currently in its fifth edition, contains guidance on how to determine PM10 road dust emissions from both paved and unpaved roads in Chapter 13, Sections 13.2.1 (updated January 2011) and 13.2.2 (updated November 2006) respectively. The methodology for determining paved and unpaved road dust emissions was determined following consultation with the FHWA Resource Center.

During interagency consultation, it was determined that due to changes in the AP-42 methodology over the years, the road dust for 1990 should be calculated using the current methodology. The 2020 NEI uses the current AP-42 methodology, so road dust emissions estimates for future years were calculated by adjusting the dust emissions from the 2020 NEI based on projected VMT growth in the nonattainment area.

[8] https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors

4.1.1 Paved Roadways

Emissions for future year paved road dust were estimated for Cochise County using the 2020 NEI, population estimates, and VMT projections. 2020 paved road dust emissions for Cochise County were obtained directly from the 2020 NEI.

Emissions for 1990 were calculated based on the AP-42 methodology used in the 2020 NEI. According to AP-42 and the 2020 NEI, paved road dust emissions can be calculated at the state or county level by multiplying VMT per road type and the appropriate emissions factor, which can be determined using the following equation:

$$E = k(sL)^{0.91} \times W^{1.02}$$

where:

E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (1.00 for PM10 and units of g/VMT),
sL = road surface silt loading (grams per square meter) (g/m^2), and
W = average weight (tons) of the vehicles traveling the road.

AP-42 and the 2020 NEI contain tables that list the appropriate values for each variable in the equation above. The value of silt loading is based on road type and average daily traffic volumes. The average vehicle weights for each county by road type were estimated based on the VMT by each vehicle type, total county VMT for all vehicle types, and the average vehicle type mass within EPA's MOVES software. Road surface silt loading values and average vehicle weights can be found in AP-42 and the 2020 NEI guidance[9].

For 1990, county level VMT by road type was not available. The 1990 FHWA Highway Statistics[10] document does contain state-level VMT by road type as well as the state-level paved and unpaved roadway mileage. Therefore, emissions were first calculated at the state level. Paved road VMT was determined by applying a factor of paved VMT to unpaved VMT that was determined in the development of the PM10 SIP for Payson, Arizona. In this SIP, ADEQ assumed that 1% of the VMT occurred on unpaved roads, where applicable. Not every road type had unpaved mileage in 1990, so this factor was only applied to road types that did have unpaved mileage to remove unpaved VMT. Once the paved VMT was determined for each road type, it was multiplied by the associated emissions factor calculated from the above equation to determine statewide emissions. Statewide emissions were then allocated to Cochise County using population estimates from the 1990 U.S. Census. **Table 20** summarizes the 1990 population estimates for the State of Arizona and Cochise County.

Table 20 – 1990 U.S. Census Population Estimates

Arizona	Cochise County	Percent of County to State
3,665,228	97,624	2.66%

Both the 1990 and 2020 emissions estimates were then apportioned to the nonattainment area. For the 1990 Census, population information for the nonattainment area was not readily available, so the population estimate of nonattainment area to County for 2020 was determined to be an acceptable proxy.

[9] https://www.epa.gov/system/files/documents/2023-03/NEI2020_TSD_Section23_Dust_PavedRoads.pdf
[10] https://rosap.ntl.bts.gov/view/dot/36034

The population of the nonattainment area was estimated at the block group level. **Table 21** summarizes the 2020 population estimates for Cochise County and the nonattainment area.

Table 21 – 2020 U.S. Census Population Estimates		
Cochise County	**Nonattainment Area**	**Percent of Nonattainment to County**
127,450	21,242	16.67%

Once 1990 and 2020 emissions estimates were determined for the nonattainment area, paved road dust emissions for future analysis were then calculated by projecting the 2020 emissions estimates to each analysis year using the estimated VMT growth in the nonattainment area.

4.1.2 Unpaved Roadways

Emissions estimates for future year unpaved road dust in the nonattainment area were developed using the 2020 NEI for Cochise County, population estimates, and VMT projections. 2020 unpaved road dust emissions for Cochise County were obtained directly from the 2020 NEI.

Emissions estimates for 1990 were developed using the AP-42 methodology used in the 2020 NEI. According to AP-42, state or county-level unpaved road dust emissions per roadway type can be developed by multiplying annual unpaved road VMT estimates by an AP-42 emissions factor. This emissions factor was calculated using the following equation from AP-42:

$$E = \frac{k\left(\frac{s}{12}\right)^{a}\left(\frac{S}{30}\right)^{d}}{\left(\frac{M}{0.5}\right)^{c}} - C$$

where:

E = size-specific emission factor (lb/VMT), calculated for each of nine unpaved roadway types
k = empirical constant = 1.8 lb/VMT; from AP-42
a = empirical constant = 1; from AP-42
d = empirical constant = 0.5; from AP-42
c = empirical constant = 0.2; from AP-42
s = surface material silt content (%) = 3.9%; average state value based on samples taken as part of the 1985 NAPAP Inventory (NEI section 24, table 24-3)
M = surface material moisture content (%)
S = mean vehicle speed (mph) = range between 39 miles per hour (mph) and 20 mph based on roadway type
C = 0.00047 lb/VMT; PM10 emission factor for 1980s vehicle fleet exhaust, brake wear, and tire wear

Surface material moisture content is the only variable that does not have a direct value designated by AP-42 or the 2020 NEI guidance as it varies throughout different regions of the country. The basis for the silt material moisture content is a study titled Improved Activity Levels for National Emission Inventories of Fugitive Dust from Paved and Unpaved Roads[11]. This study collected soil data across the country to determine levels of material moisture content. A portion of the study was conducted in 1990 in three

[11] https://gaftp.epa.gov/ap42/ch13/s021/references/ref_24c13s0201_2011.pdf

counties in Arizona – Pinal County, Pima County, and Yuma County. The measured material moisture contents of the counties are shown below in **Table 22**.

Table 22 – 1990 Measured Material Moisture Content	
County	**Moisture Content**
Pinal	0.20
Pima	0.22
Yuma	0.17
Average	0.197

The average moisture content of the three values take in Arizona is 0.197. For the 1990 analysis, this average value was used as the silt material moisture content. As in the 1990 paved road dust methodology, unpaved road dust emissions were first calculated at the state level due to lack of county-level data. The unpaved statewide VMT was determined by applying the 1% factor from the Payson, Arizona SIP to the statewide total VMT for road types that had unpaved road mileage. The unpaved mileage by road type was multiplied by the associated emissions factor calculated from the above equation to determine statewide unpaved road dust emissions.

Statewide emissions were then allocated to Cochise County using the same factor as paved road dust seen in **Table 20**. Both the 1990 and 2020 County emissions estimates were then apportioned to the nonattainment area using the factor of nonattainment area population to County population as seen in **Table 21**. Once 1990 and 2020 emissions estimates were determined for the nonattainment area, unpaved road dust emissions for future analysis years were projected based on estimated VMT growth in the nonattainment area.

Additional adjustment was not included related to the proposed project for paving a portion of an unpaved road, because of the low project level volume that exists on the roadway today is negligible related to the regional analysis.

4.1.3 Road Dust Emissions Results

Table 23 displays the total dust emissions from the 2020 NEI for Cochise County and the nonattainment area. **Table 24** displays the results of the paved and unpaved road dust emissions calculations by analysis year.

Table 23 – Dust Emissions from the 2020 NEI for Cochise County and the Nonattainment Area		
Source	**Cochise County**	**Nonattainment Area**
Unpaved Road Dust	1106.32	184.39
Paved Road Dust	156.24	26.04
Total	**1262.56**	**210.43**

Table 24 – Final Road Dust Emissions by Analysis Year					
Source Type ID	**Analysis Year**				
	1990	**2028**	**2035**	**2040**	**2050**
Unpaved Road Dust	347.94	216.04	248.16	273.99	334.00
Paved Road Dust	71.89	30.51	35.05	38.69	47.17
Total	**442.33**	**246.55**	**283.21**	**312.69**	**381.16**

4.2 Total PM10 Emissions

Emissions from all processes were combined to estimate the overall impact of on-road mobile sources on PM10 levels in the Paul Spur/Douglas nonattainment area. **Table 25** and **Figure 3** show these emissions for all analysis years, along with the values used to calculate paved road dust emissions.

Table 25 – Paul Spur/Douglas Particulate Matter (PM10) Conformity Analysis

Source	1990	2028	2035	2040	2050
	(Tons/Year)				
Unpaved Road Dust	347.94	216.04	248.16	273.99	334.00
Paved Road Dust	71.89	30.51	35.05	38.69	47.17
On-Road Emissions (exhaust, brake, and tire wear included)	22.49	10.30	11.67	12.74	16.02
Total	442.33	256.85	294.89	325.43	397.18

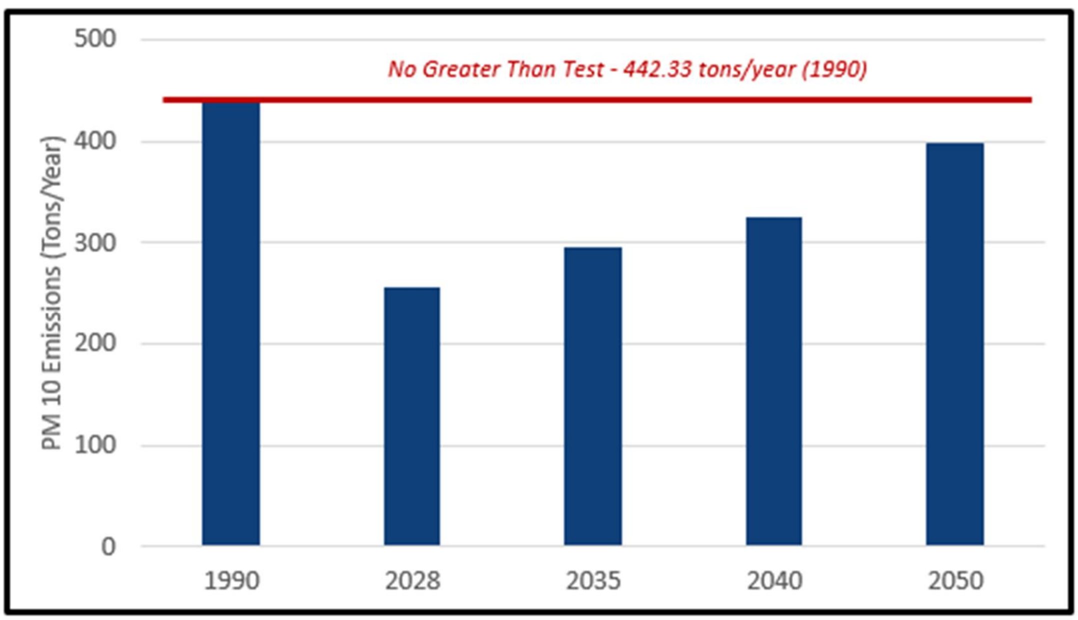

Figure 3: Interim PM10 Emissions Test

5. CONFORMITY DETERMINATION

The analysis indicates that the projected emissions levels for the Paul Spur/Douglas nonattainment area meet the applicable conformity tests with the planned Douglas Commercial Port of Entry Connector Road project. Therefore, it is the determination of this analysis that this plan conforms under the 24-hour PM10 National Ambient Air Quality Standards (NAAQS).

APPENDIX A
Pre-Analysis Consensus Memoranda

Kimley»Horn

Disclaimer: This memo provides initial modeling assumptions. During Interagency Consultation, portions of this memo were adjusted. See report for final methodology.

1990 Baseline Pre-Analysis Consensus Memorandum

To:	Beverly Chenausky, Arizona Department of Transportation (ADOT)
From:	Allison Fluitt, P.E., AICP Kimley-Horn and Associates, Inc.
Date:	February 16, 2024
Subject:	Douglas Non-Attainment Area Air Quality Conformity 1990 Baseline Pre-Analysis Consensus Memorandum

Background

The purpose of this memo is to detail the assumptions and procedures that will be used in the regional air quality conformity 1990 baseline analysis for the Paul Spur/Douglas planning area in Cochise County, Arizona. The Paul Spur/Douglas planning area is currently in non-attainment for large particulates, otherwise known as PM10. This area was designated as a moderate non-attainment area on Oct. 31, 1990 (55 FR 45799). As an isolated rural non-attainment area, the Paul Spur/Douglas planning area is subject to a regional air quality conformity process. The planned Douglas Commercial Port of Entry Connector Road is likely to be classified as regionally significant and is not within a conforming Transportation Improvement Program (TIP). As such, a PM10 regional air quality conformity analysis will be required to complete this project.

Only the data, methodology, and assumptions needed for the 1990 baseline analysis are included in this memorandum. Data, methodology, and assumptions for the other years have been documented in previous efforts.

Conformity Test

Regional air quality conformity is most commonly determined by comparing the future year emissions to a motor vehicle emission budget (MVEB) established by the State Implementation Plan (SIP). However, if an area does not have an approved MVEB, an interim emissions test may be performed to determine conformity. The two types of interim emissions tests consist of:

- Demonstrating that future year “build” emissions (representing projects included within a TIP or LRTP) are not greater than emissions from a baseline “no-build” scenario, referred to as a “build/no-build” test.
- Demonstrating that the future year “build” emissions are not greater than the emissions from a baseline year for a given standard, referred to as the “no greater than” test.

At this time, the Paul Spur/Douglas PM10 area does not have an approved MVEB, meaning than an interim conformity test will be used. Specifically, the no-greater-than-baseline year emissions test is proposed to be used to demonstrate regional conformity. The Douglas area was designated as a non-attainment area under the 1987 24-hour PM10 standard, which was retained under the Environmental Protection Agency's (EPA's) 2006 PM National Ambient Air Quality Standards (NAAQS) review (effective December 18, 2006). The baseline year is defined as the most recent year for which EPA's Air Emissions Reporting Rule requires submission of on-road mobile source emissions inventories as of the effective date of designation, which is 1990 for the 2006 PM NAAQS. The PM10 non-attainment area is shown in **Figure 1**.

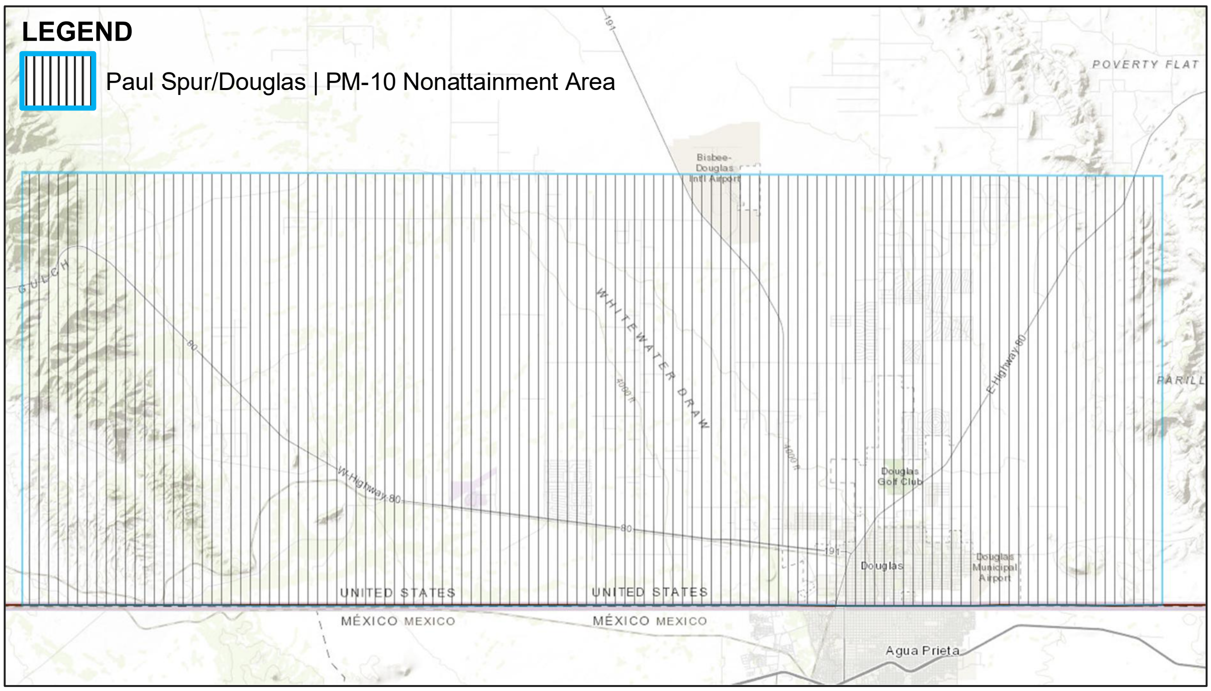

Figure 1. PM10 Non-Attainment Area (AZDEQ)[1]

[1] https://azdeq.gov/node/3943

On-Road Emissions

The on-road PM10 emissions will be modeled using EPA's Motor Vehicle Emissions Simulator 3.1 (MOVES3.1) software. Several parameters have been identified for use in the preparation of this analysis. The parameters listed below will be applied in the base MOVES3.1 setup:

- Description
  - Use this to document the purpose of each run (e.g., "base year)
- Scale
  - Domain/Scale: County
  - Calculation Type: Inventory
- Time Span:
  - Years: 1990
  - Months:
    - PM 10: All Months
  - Days: Weekdays and Weekends
  - Hours: All Hours
- Geographic Bounds: Arizona – Cochise County
- Vehicles/Equipment
  - All Available Fuel Types
    - Compressed Natural Gas (CNG)
    - Diesel Fuel
    - Electricity
    - Ethanol (E85)
    - Gasoline
  - All Available Source Types
    - Combination Long-haul Truck
    - Combination Short-haul Truck
    - Intercity Bus
    - Light Commercial Truck
    - Motor Home
    - Motorcycle
    - Passenger Car
    - Passenger Truck
    - Refuse Truck
    - School Bus
    - Single Unit Long-haul Truck
    - Single Unity Short-haul Truck

        - Transit Bus
- Road Type
    - All road types including off-network

- Pollutants and Processes:
    - Pollutants:
        - PM10, and any additional pre-requisites.
    - Processes: All processes

- General Output:
    - Mass Units: Grams
    - Energy Units: Joules
    - Distance Units: Miles
    - Activity: Distance Traveled, Population

The following assumptions will be applied within the County Data Manager portion of the MOVES3.1 software package. Each parameter is identified, along with the source data that will be applied (if applicable). Due to the rural nature of the Paul Spur/Douglas non-attainment area, local data is not readily available for all input files. Where local data is unavailable, more detail is provided for the data sources being used for the affected input areas.

- Age Distribution: January 2003 vehicle registration data for Cochise County will be obtained from Motor Vehicle Division (MVD) reports, furnished by ADOT. January 2003 is the oldest MVD data available for this area. The age distribution associated with January 2003 will be used for 1990.

- Source Type Population: January 2003 vehicle registration data will be obtained from MVD reports for Cochise County, in addition to the 2008 and 2020 information gathered previously. January 2003 is the oldest MVD data available for this area. The MVD data will be reviewed to determine if any adjustments need to be made to source types 61 and 62, similar to the remainder of the analysis. If adjustments are needed, MOVES default data for 1990 will be used in place of the MVD data. 1990 source type population for Cochise County will be developed by extrapolating the 2003 data to 1990 using overall county population totals from the U.S. Census. The source type population for the nonattainment area will be developed using the same process as was completed previously for 2008 and 2022 (see report).

- Meteorology Data: Local meteorological data for all months of 1990 at the Douglas International Airport will be obtained from the National Centers for Environmental Information (NCEI) website developed by the National Oceanic and Atmospheric Administration (NOAA).

- Inspection/Maintenance (I/M) Programs: No I/M program information will be applied.

- Vehicle Type VMT (Highway Performance Monitoring System [HPMS]): ADOT does not have reliable HPMS VMT data for 1990. The earliest VMT data available through ADOT is from 2007, but only includes Average Annual Daily Traffic (AADT) for interstates, US routes, and state routes. 2013 AADT data is available for additional roads and is the oldest data set that can be reliably used to develop VMT for the nonattainment area. This data is provided for passenger vehicles, single unit trucks, and combination unit trucks. 1990 VMT data for these three vehicle types will be developed by extrapolating the 2013 data to 1990 using population totals for the nonattainment area from the U.S. Census. This VMT data will be distributed to the HPMS vehicle classes using distributions from default MOVES data for 1990, as is consistent with methodology used for the 2022 data in the remainder of the analysis.

- Day/Month/Hour VMT Fraction: Locally available data sources do not provide information that allows for the generation of VMT by time of day. Discussions with ADOT considered surrogate data sources elsewhere in the state but determined that these sources were not of sufficient quality to use for the Douglas area. As a result, the final VMT data for nonattainment area will be input into EPA's AADVMT converter to develop all three VMT fractions to remain consistent with the other analysis years for regional conformity. This process was already vetted by the IAC during the development of those years.

- Fuels: There is no locally available fuels data for the Douglas area. Default data is extracted from MOVES3.1. Note: MOVES 3.1 was the most up to date available MOVES program in effect at the inception of this analysis process. As such, this version is being carried forward to complete the analysis.

- Road Type Distribution: HPMS data for 2013 will be used to determine the road type distribution. The distribution for 2013 will be used for 1990 due to the lack of more detailed data noted in the Vehicle Type VMT description. This is consistent with the way the previous 2008 road type distribution was developed.

- Average Speed Distribution: Default data will be used because more detailed data is not available at a regional or state level. This is consistent with the other model years in this analysis. Default data is extracted from MOVES3.1.

- Starts: No input necessary

- Hoteling: No input necessary

Paved, Unpaved, and Construction Road Dust

There are two methodologies that could be used for 1990 paved and unpaved road dust. We ask the members of the IAC to weigh the two options detailed here and determine which option is the best for use in this regional conformity analysis.

The first option is to use the values developed in the 1990 NEI for PM10 in Cochise County. After discussions with EPA and FHWA, along with reading language on EPA's website, it appears that this is not a supported method as calculation methods have changed.

The second option involves calculating estimates of road dust emissions. To develop new estimates of road dust emissions for 1990, the current AP-42 emissions factor equation and trends assumptions must be used. Unfortunately, county-level data for 1990 is not expansive. So, emissions can be calculated at the state level and then apportioned to Cochise County and the nonattainment area using population information from the U.S. Census.

Available 1990 data for this analysis includes the following:

- State-level mileage and VMT estimates for 1990 by 12 road types (seen below) taken from FHWA's 1990 *Highway Statistics* report

Rural	Urban
Interstate	Interstate
Other Principal Arterial	Other Freeways & Expressways
Minor Arterial	Other Principal Arterial
Major Collector	Minor Arterial
Minor Collector	Collector
Local	Local

- County-level rural and total population estimates from the U.S. Census
- Total county-level daily VMT developed by ADOT broken down into state highway system VMT and local and federal agencies VMT
- Paved and unpaved mileage by road type from FHWA's *Highway Statistics* report, including all road types above except rural and urban local
- Fleet average vehicle weight for 1990 from the NEI Procedures Document

Paved and unpaved VMT is not available. To determine estimates of unpaved VMT at the state-level, the ratio of unpaved mileage to total mileage for each road type will be applied to the total VMT for each functional class. Paved VMT can then be calculated by subtracting unpaved VMT from the total VMT.

VMT by vehicle type for 1990 is not available. Instead, the fleet average vehicle weight for 1990 of 6,360 lbs was taken from Section 4.8.1.5 of the NEI Procedures Document 1985-1999.

Paved Roadways

According to the 2020 NEI, paved road dust emissions can be calculated by multiplying VMT per road type and the appropriate emissions factor as described in AP-42, which can be determined using the following equation:

$$E = k(sL)^{0.91} \times W^{1.02}$$

where:

E = particulate emission factor (having units matching the units of k),

k = particle size multiplier for particle size range and units of interest (1.00 for PM10 and units of g/VMT),

sL = road surface silt loading (grams per square meter) (g/m^2), and

W = average weight (tons) of the vehicles traveling the road.

The 2020 NEI documentation for Paved Road Dust contains a table that lists the appropriate values for silt loading by road type based on the ADTV range. Once the emission factors are developed for each road type, they will be multiplied by the paved VMT for each road type to calculate state-level emissions. Then, state-level emissions will be apportioned to the County and then to the non-attainment area through a comparison of population totals taken from the U.S. Census.

Unpaved Roadways

According to the NEI, unpaved road emissions can be calculated by multiplying unpaved VMT per road type by the appropriate emissions factor as described in AP-42, which can be determined using the following equation:

$$E = \frac{k\left(\frac{s}{12}\right)^a\left(\frac{S}{30}\right)^d}{\left(\frac{M}{0.5}\right)^c} - C$$

where:

E = size-specific emission factor (lb/VMT), calculated for each of nine unpaved roadway types

k = empirical constant = 1.8 lb/VMT; from AP-42

a = empirical constant = 1; from AP-42

d = empirical constant = 0.5; from AP-42

c = empirical constant = 0.2; from AP-42

s = surface material silt content (%) = 3.0%; average state value based on samples taken as part of the 1985 NAPAP Inventory (AZ is on this table twice and has values of either 3.0% or 3.9%, NEI section 24, table 24-3)

M = surface material moisture content (%) = 0.5% (conservative national default value used for the NEI)

S = mean vehicle speed (mph) = range between 39 miles per hour (mph) and 20 mph based on roadway type

C = 0.00047 lb/VMT; PM10 emission factor for 1980s vehicle fleet exhaust, brake wear, and tire wear

The emissions factor for each unpaved road type can then be multiplied by the corresponding unpaved VMT estimates for each road type to calculate emissions at the state level. State-level emissions were allocated to Cochise County based on a ratio of rural population in the county to the state per data from the U.S. Census. Non-attainment area emissions estimates can then be developed using the same ratio of non-attainment area population to county population as in the paved roadways analysis.

Road Construction

The calculations for estimating the emissions from road construction involve first estimating the acres disturbed from new road construction. The amount of state-level road construction spending by road type is available from the Federal Highway Administration (FHWA) and is converted to acreage disturbed using conversion factors from the Florida Department of Transportation (FDOT). The state-level acreage disturbed by road type can then be summed together and distributed to Cochise County based on the proportion of building starts in the county. The emissions factor for PM10 can then be calculated based on the precipitation-evaporation value and dry silt content for Cochise County using the following equation:

$$UEF_{PM10,c} = EF_{PM10} \times \frac{24}{PE_s} \times \frac{S_c}{9\%}$$

where:

$UEF_{PM10,c}$ = Uncontrolled PM10 emission factor corrected for soil moisture and silt content in state s and county c, in tons/acre-month

EF_{PM10} = Initial PM10 emissions for road construction, 0.42 tons/acre-month

PE_s = Precipitation-evaporation value for state s

S_c = Percent dry silt content in soil for county c

The total amount of acres disturbed is multiplied by this emissions factors to estimate emissions of at the county-level. Non-attainment area emissions estimates can then be developed using the same ratio of non-attainment area population to county population as in the paved and unpaved roadway analyses.

Next Steps

We ask the IAC to review this content and offer any comments, edits, or questions no later than end of day **Thursday, February 29, 2024**. Following the feedback received by the project team, we will proceed with the development of the 1990 baseline analysis for regional conformity.

Kimley»Horn

Disclaimer: This memo provides initial modeling assumptions. During Interagency Consultation, portions of this memo were adjusted. See report for final methodology.

Pre-Consensus Memorandum

To:	Beverly Chenausky, Arizona Department of Transportation (ADOT)
From:	Allison Fluitt, P.E., AICP Kimley-Horn and Associates, Inc.
Date:	June 2, 2023; Updated September 7, 2023
Subject:	Douglas Non-Attainment Area Air Quality Conformity Pre-Consensus Memorandum

Background

The purpose of this memo is to detail the assumptions and procedures that will be used in the regional air quality conformity analysis for the Paul Spur/Douglas planning area in Cochise County, Arizona. The Paul Spur/Douglas planning area is currently in non-attainment for large particulates, otherwise known as PM10. This area was designated as a moderate non-attainment area on Oct. 31, 1990 (55 FR 45799). As an isolated rural non-attainment area, the Paul Spur/Douglas planning area is subject to a regional air quality conformity process. The planned Douglas Commercial Port of Entry Connector Road is likely to be classified as regionally significant and is not within a conforming Transportation Improvement Program (TIP). As such, a PM10 regional air quality conformity analysis will be required to complete this project.

Conformity Test

Regional air quality conformity is most commonly determined by comparing the future year emissions to a motor vehicle emission budget (MVEB) established by the State Implementation Plan (SIP). However, if an area does not have an approved MVEB, an interim emissions test may be performed to determine conformity. The two types of interim emissions tests consist of:

- Demonstrating that future year "build" emissions (representing projects included within a TIP or LRTP) are not greater than emissions from a baseline "no-build" scenario, referred to as a "build/no-build" test.
- Demonstrating that the future year "build" emissions are not greater than the emissions from a baseline year for a given standard, referred to as the "no greater than" test.

At this time, the Paul Spur/Douglas PM10 area does not have an approved MVEB, meaning than an interim conformity test will be used. Specifically, the no-greater-than-baseline year emissions test is proposed to be used to demonstrate regional conformity. The Douglas area was designated as a non-attainment area under the 1987 24-hour PM10 standard, which was retained under the Environmental Protection Agency's (EPA's) 2006 PM National Ambient Air Quality Standards (NAAQS) review (effective December 18, 2006). The baseline year is defined as the most recent year for which EPA's

Air Emissions Reporting Rule requires submission of on-road mobile source emissions inventories as of the effective date of designation, which is 2008 for the 2006 PM NAAQS. The PM10 non-attainment area is shown in **Figure 1**.

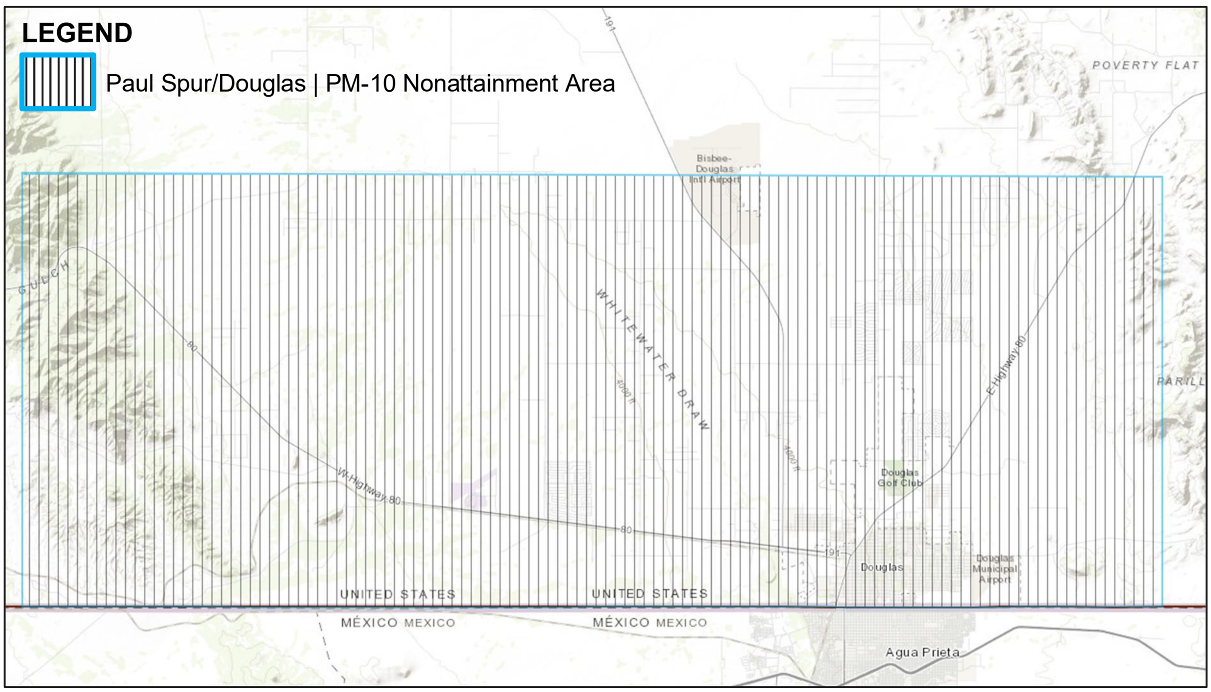

Figure 1. PM10 Non-Attainment Area (AZDEQ)[1]

The planning horizon years were identified based on correspondence with the Interagency Consultation Group on August 21, 2023. These years are 2028, 2035, 2040, and 2050.

On-Road Emissions

The on-road PM10 emissions will be modeled using EPA's Motor Vehicle Emissions Simulator 3.1 (MOVES3.1) software. Several parameters have been identified for use in the preparation of this analysis. The parameters listed below will be applied in the base MOVES3.1 setup:

- Description
    - Use this to document the purpose of each run (e.g., "base year, "2008 No-build", etc.)

[1] https://azdeq.gov/node/3943

- Scale
    - Domain/Scale: County
    - Calculation Type: Inventory

- Time Span:
    - Years: 2008, 2028, 2035, 2040, and 2050
    - Months:
        - PM 10: All Months
    - Days: Weekdays
    - Hours: All Hours

- Geographic Bounds: Arizona – Cochise County

- Vehicles/Equipment
    - All Available Fuel Types
        - Compressed Natural Gas (CNG)
        - Diesel Fuel
        - Electricity
        - Ethanol (E85)
        - Gasoline
    - All Available Source Types
        - Combination Long-haul Truck
        - Combination Short-haul Truck
        - Intercity Bus
        - Light Commercial Truck
        - Motor Home
        - Motorcycle
        - Passenger Car
        - Passenger Truck
        - Refuse Truck
        - School Bus
        - Single Unit Long-haul Truck
        - Single Unity Short-haul Truck
        - Transit Bus
- Road Type
    - All road types including off-network

- Pollutants and Processes:
    - Pollutants:
        - PM10, and any additional pre-requisites.
    - Processes: All processes

- General Output:
    - Mass Units: Grams

- Energy Units: Joules
- Distance Units: Miles
- Activity: Distance Traveled, Population

The following assumptions will be applied within the County Data Manager portion of the MOVES3.1 software package. Each parameter is identified, along with the source data that will be applied (if applicable). Due to the rural nature of the Paul Spur/Douglas non-attainment area, local data is not readily available for all input files. Where local data is unavailable, more detail is provided for the data sources being used for the affected input areas.

- Age Distribution: January 2008, July 2008, and January 2020 vehicle registration data for the Douglas area will be obtained from Motor Vehicle Division (MVD) reports, furnished by ADOT. EPA's age distribution forecasting tool will be used to create age distribution files for each analysis year.

- Source Type Population: 2008 and 2020 source type population information will be obtained for the Douglas area from MVD reports, furnished by ADOT. Future year growth will be obtained by determining annual growth rates in Vehicle Miles Traveled (VMT) generated from information contained within the City of Douglas International Port of Entry Connector Road Final Traffic Report, and then applying those growth rates to the source type population data for each study year.

- Meteorology Data: Local meteorological data for all months will be obtained from the National Centers for Environmental Information (NCEI) website developed by the National Oceanic and Atmospheric Administration (NOAA).

- Inspection/Maintenance (I/M) Programs: No I/M program information will be applied

- Vehicle Type VMT (Highway Performance Monitoring System [HPMS]): The daily VMT by vehicle type for Cochise County will be obtained from ADOT. The ADOT Statewide Travel Demand Model (TDM) will be used to factor the County VMT within the Paul Spur/Douglas planning area. Future year VMT will be obtained by generating annual growth rates from information contained within the City of Douglas International Port of Entry Connector Road Final Traffic Report.

- Hourly VMT Fraction: Locally available data sources do not provide information that allows for the generation of VMT by time of day. Discussions with ADOT considered surrogate data sources elsewhere in the state but determined that these sources were not of sufficient quality to use for the Douglas area. As a result, default data will be used for hourly VMT fractional distributions by roadway type and vehicle type (Default data is extracted from the most up to date available MOVES program (MOVES3.1)).

- Fuels: There is no locally available fuels data for the Douglas area. Default data is extracted from the most up to date available MOVES program (MOVES3.1).

- Road Type Distribution: County-wide HPMS data will be used to determine the road type distribution.
- Average Speed Distribution: Default data will be used because more detailed data is not available at a regional or state level (Default data is extracted from the most up to date available MOVES program (MOVES3.1)).
- Starts: No input necessary
- Hoteling: No input necessary

Paved and Unpaved Road Dust

The primary contributor to PM10 emissions in the Paul Spur/Douglas nonattainment area is road dust from paved and unpaved roads. Emissions for road dust were calculated using the AP-42[2]. The *AP-42, Compilation of Air Pollutant Emission Factors*, has been published since 1972 as the primary compilation of EPA's emission factor information. This document, currently in its fifth edition, contains guidance on how to determine PM10 road dust emissions from both paved and unpaved roads. The methodology for determining paved and unpaved road dust emissions will be confirmed following consultation with IAC.

Paved Roadways

Emissions for paved road dust were estimated for Cochise County using the 2020 NEI and were then distributed to the non-attainment area using a population comparison. According to the 2020 NEI, paved road dust emissions can be calculated at the county level by multiplying VMT per road type and the appropriate emissions factor as described in AP-42, which can be determined using the following equation:

$$E = k(sL)^{0.91} \times W^{1.02}$$

where:

E = particulate emission factor (having units matching the units of k),

k = particle size multiplier for particle size range and units of interest (1.00 for PM10 and units of g/VMT),

sL = road surface silt loading (grams per square meter) (g/m^2), and

W = average weight (tons) of the vehicles traveling the road.

[2] https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors

The 2020 NEI contains tables that list the appropriate values for each variable in the equation above. The value of silt loading is based on road type and average daily traffic volumes. The average vehicle weights for each county by road type were estimated based on the VMT by each vehicle type, total county VMT for all vehicle types, and the average vehicle type mass within EPA's MOVES software. Control factors were applied to the emissions factor based on the assumed control measure of vacuum sweeping of paved roads twice per month. Because the area is considered a moderate non-attainment area, the control factors were only applied to urban roads. A meteorological adjustment was also applied in the NEI to account for the reduction in road dust emissions from precipitation and other meteorological factors.

County-level emissions were apportioned to the non-attainment area through a comparison of non-attainment area population to county population. Methodology for determining the non-attainment area population will be confirmed through consultation with the Interagency Consultation (IAC) Group.

2020 non-attainment area emissions were forecast to each analysis year using county-wide population growth estimates developed using forecasts provided by the Arizona Department of Administration, Employment and Population Statistics, Office of Economic Opportunity.

Unpaved Roadways

Emissions estimates for unpaved road dust in the non-attainment area were developed using the 2020 NEI for Cochise County and recent rural population estimates and forecasts. County-level unpaved road dust emissions per roadway type were developed by multiplying annual unpaved road VMT estimates by an AP-42 emissions factor. This emissions factor was calculated using the following equation from AP-42:

$$E = \frac{k\left(\frac{s}{12}\right)^{a}\left(\frac{S}{30}\right)^{d}}{\left(\frac{M}{0.5}\right)^{c}} - C$$

where:

E = size-specific emission factor (lb/VMT), calculated for each of nine unpaved roadway types

k = empirical constant = 1.8 lb/VMT; from AP-42

a = empirical constant = 1; from AP-42

d = empirical constant = 0.5; from AP-42

c = empirical constant = 0.2; from AP-42

s = surface material silt content (%) = 3.0%; average state value based on samples taken as part of the 1985 NAPAP Inventory (AZ is on this table twice and has values of either 3.0% or 3.9%, NEI section 24, table 24-3)

M = surface material moisture content (%) = 0.5% (conservative national default value used for the NEI)

S = mean vehicle speed (mph) = range between 39 miles per hour (mph) and 20 mph based on roadway type

C = 0.00047 lb/VMT; PM10 emission factor for 1980s vehicle fleet exhaust, brake wear, and tire wear

As in the paved road emissions methodology, controls were only applied to urban roads due to the area being denoted as a moderate non-attainment area. The control factor listed in the NEI for unpaved roads is assumed to be paving of the road. A meteorological adjustment was also applied to the unpaved road emissions to account for the reduction in emissions from precipitation and other meteorological events.

Annual unpaved road VMT by roadway type were first estimated at the state-level based on Federal Highway Administration (FHWA) data on unpaved road lengths by road type and annual average daily traffic (AADT). State-level VMT estimates were then allocated to Cochise County based on a ratio of rural population in the county to the state per the 2020 U.S. Census. Non-attainment area VMT estimates were developed using the same ratio of non-attainment area population to county population as in the paved roadways analysis.

2020 non-attainment area emissions were forecast to each analysis year using county-wide population growth estimates developed using forecasts provided by the Arizona Department of Administration, Employment and Population Statistics, Office of Economic Opportunity.

Documentation

Documentation of the air quality conformity analysis will be prepared as a stand-alone deliverable. Following the conclusion of the analysis and preparation of documentation, these materials will be presented to the IAC group for review. Feedback received during this process will be incorporated as needed into the analysis and final documentation.

APPENDIX B

City of Douglas International Port of Entry Connector Road Final Traffic Study

FINAL TRAFFIC REPORT

CITY OF DOUGLAS INTERNATIONAL PORT OF ENTRY CONNECTOR ROAD
ADOT SOUTHEAST DISTRICT/COCHISE COUNTY

ADOT CONTRACT NO. 2023-003
ADOT PROJECT NO. F0534 01L
FEDERAL PROJECT NO. 999-A(561)T

Prepared For:

ADOT

ARIZONA DEPARTMENT OF TRANSPORTATION
MULTIMODAL PLANNING DIVISION
CORRIDOR PLANNING GROUP

Prepared By:

Kimley»Horn

JUNE 2023

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ARIZONA U.S.A.
Exp. 09-30-23

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1. INTRODUCTION

This Final Traffic Report has been developed to support the Design Concept Report (DCR) for a connector road between the proposed Douglas Commercial International Port of Entry (IPOE) at the United States (U.S.)-Mexico border and Arizona State Route 80 (SR 80). The project is located in the Arizona Department of Transportation (ADOT) Southeast District in Cochise County west of Douglas, Arizona and is anticipated to open in 2028. The project location and vicinity maps are shown in **Figure 1.1** and **Figure 1.2**, respectively.

There are three alignment alternatives currently being considered for the proposed connector road west of United States Route 191 (US 191), two of which intersect SR 80 at James Ranch Road and one of which intersects SR 80 at Brooks Road. The three alignment alternatives are shown in **Figure 1.3**. For the purposes of this report, the preferred alignment alternative for the connector road is assumed to intersect SR 80 at the existing SR 80 / James Ranch Road intersection. The results of the analysis at the SR 80 / James Ranch Road intersection are anticipated to be similar at the SR 80 / Brooks Road intersection if the preferred alignment alternative for the connector road intersects SR 80 at Brooks Road instead of James Ranch Road.

The purpose of this report is to document the existing safety and operational characteristics of the SR 80 / James Ranch Road intersection, develop and evaluate intersection configuration alternatives at the SR 80 / James Ranch Road intersection, identify appropriate roadway geometry for the connector road, and provide recommendations for improvements within the study area that provide acceptable future traffic operations, promote safety, and enhance regional mobility.

The traffic analysis includes the evaluation of the following intersection configuration alternatives at the intersection of SR 80 / James Ranch Road:

- Two-Way Stop Control (TWSC)
- Traffic Signal Control
- Roundabout

Additionally, it is anticipated that all truck traffic entering the U.S. will continue to be required to travel to the ADOT Commercial Inspection Facility, which is currently located on the northeast corner of the intersection of SR 80 / US 191, for additional processing. Because the location of the proposed commercial IPOE would change the travel patterns of commercial trucks accessing the ADOT Commercial Inspection Facility, the intersection of SR 80 / US 191 was also studied in this analysis to determine the necessary lane configuration and signal phasing at the intersection. No changes in intersection control type were analyzed for this intersection.

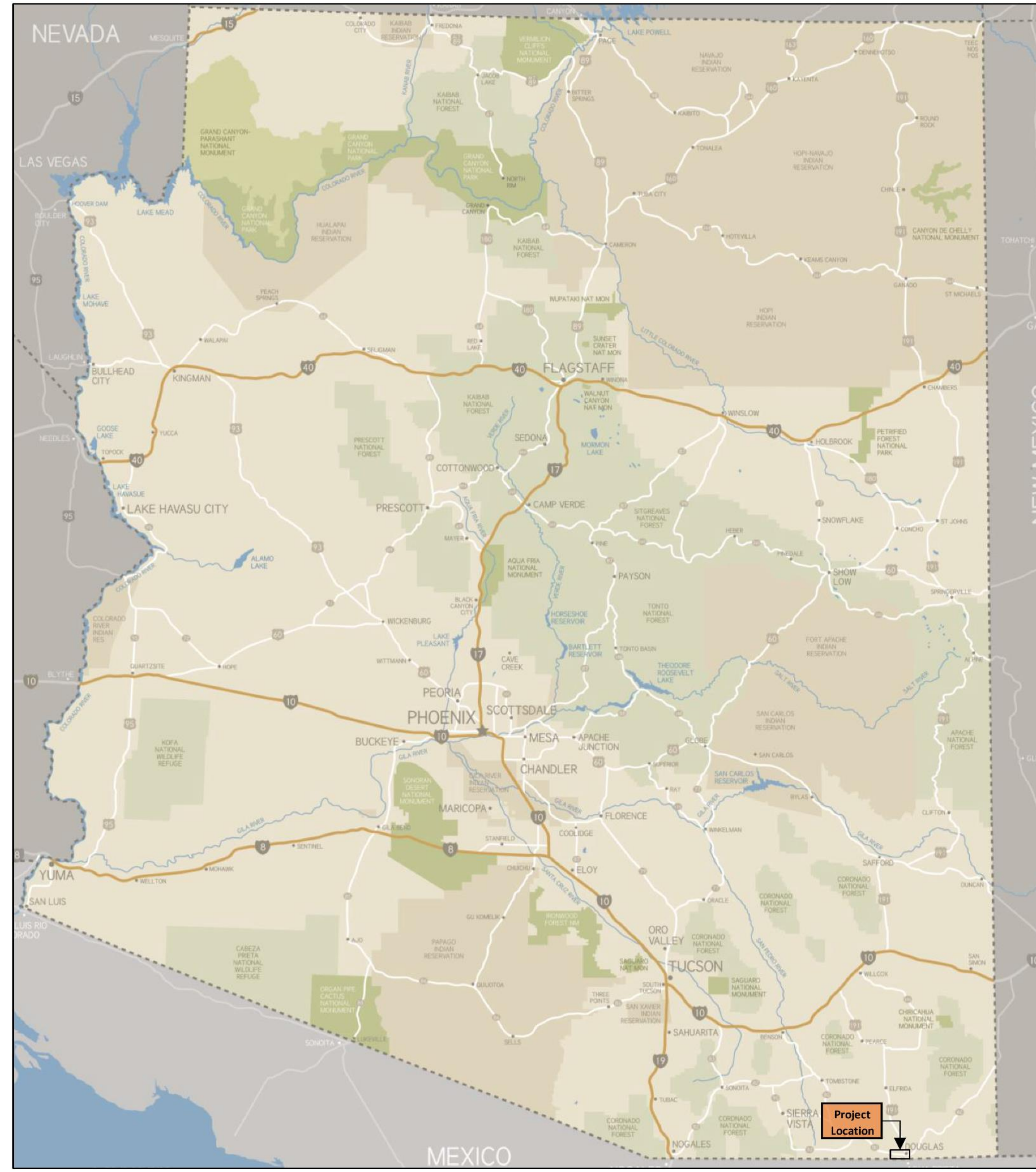


Figure 1.1 – Project Location Map

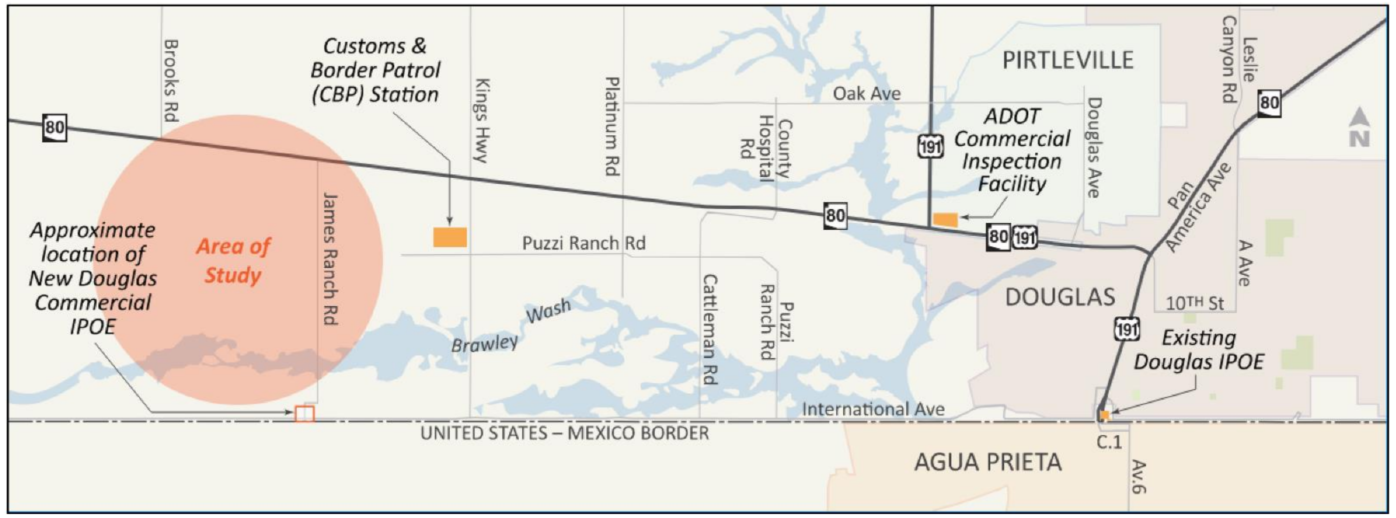


Figure 1.2 – Project Vicinity Map

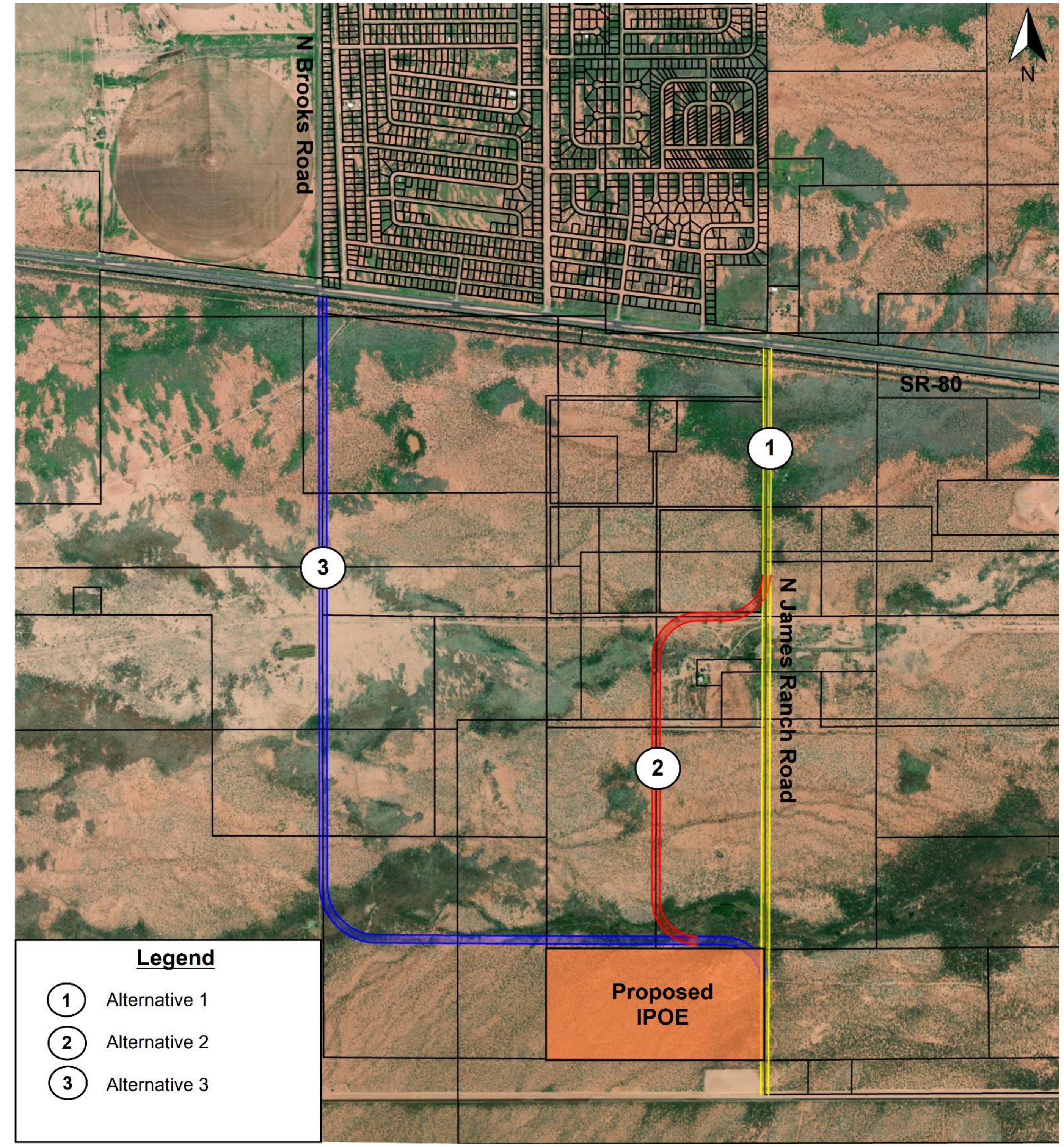


Figure 1.3 – Connector Road Alignment Alternatives Map

2. EXISTING CONDITIONS

2.1 Transportation System Overview

The existing roadway system within the study area includes SR 80, US 191, and James Ranch Road. Other notable roadways in the project vicinity include US 191 Business (Pan American Avenue) and Chino Road. This report analyzes the intersections of SR 80 / James Ranch Road and SR 80 / US 191.

2.1.1 Regional Roadway Network

SR 80 generally runs east-west in the study area and is owned, operated, and maintained by ADOT. Per the ADOT "Arizona Roads by Federal Functional Classifications" GIS map, ADOT classifies SR 80 as an "urban principal arterial – other" roadway within the study area. The posted speed limit on SR 80 is 65 miles per hour (mph) in the vicinity of James Ranch Road and is 55 mph in the vicinity of US 191. The existing SR 80 roadway section in the study area typically includes two 12-foot-wide through lanes in both the eastbound (EB) and westbound (WB) directions. An approximately 28-foot-wide median separates the EB and WB through lanes. The median is generally unpaved except for raised medians for left-turn lanes at intersections and bridge crossings. Inside paved shoulders are typically four feet wide or less and outside paved shoulders are typically ten feet wide.

US 191 generally runs north-south in the study area and is owned, operated, and maintained by ADOT. US 191 extends north from SR 80 approximately four miles east of James Ranch Road and approximately 1.5 miles west of US 191 Business (Pan American Avenue) in Douglas. ADOT classifies US 191 as an "urban minor arterial" roadway within the study area. The posted speed limit on US 191 is 45 mph within the study area. The existing US 191 roadway section in the study area typically includes one 12-foot-wide through lane in both the northbound (NB) and southbound (SB) directions separated by a 12-foot-wide two-way left-turn lane (TWLTL) that converts to an exclusive SB left-turn lane approaching SR 80.

***US 191 Business* (also known as Pan American Avenue)** is located outside the study area but is notable because it serves as a connector road between SR 80 and the existing Raul H. Castro IPOE (RHC IPOE). US 191 Business generally runs north-south and is owned, operated, and maintained by the City of Douglas. US 191 Business goes from the U.S.-Mexico border to where SR 80 has a 90-degree bend in Douglas. The existing Raul H. Castro IPOE (RHC IPOE) is located at the southern terminus of US 191 Business at the U.S.-Mexico border. ADOT classifies US 191 Business as an "urban principal arterial – other" roadway between SR 80 and the U.S.-Mexico border. The posted speed limit on US 191 Business is 35 mph. The existing US 191 Business roadway section includes two through lanes in both the NB and SB directions, separated by a TWLTL, along with curb/gutter, sidewalk, and a shared use path on the west side.

2.1.2 Local Roadway Network

James Ranch Road runs north-south in the study area and is currently a privately-owned unpaved two-lane local roadway. James Ranch Road is anticipated to serve as the connector road between the proposed commercial IPOE at the U.S.-Mexico border and SR 80 (assuming that James Ranch Road is the preferred alignment alternative for the connector road). The parcels along the James Ranch Road alignment south of SR 80 are zoned as "C-Developing" by Cochise County and are anticipated to contain industrial and/or commercial land uses in the future when the proposed commercial IPOE connector road is constructed.

Chino Road is currently located outside the study area but is notable because it serves as a connector road between SR 80 and US 191 Business. Chino Road generally runs north-south and is owned, operated, and maintained by the City of Douglas. Chino Road currently intersects SR 80 approximately 0.45 miles east of US 191 and intersects US 191 Business approximately 0.15 miles north of the RHC IPOE. ADOT classifies Chino Road as an "urban minor arterial" roadway. The existing Chino Road roadway section near SR 80 includes one through lane in both the NB and SB directions along with paved shoulders that vary from one foot to eight feet in width. The City of Douglas is planning to realign Chino Road to tie into the currently barricaded south leg of the intersection of SR 80 / US 191 by 2028 but this improvement is not yet funded.

2.1.3 Intersections

The TWSC intersection of ***SR 80 / James Ranch Road*** is located near milepost 360.6 along SR 80. The EB and WB approaches to the intersection each have a left-turn lane, a through lane, and a shared through/right-turn lane. The NB and SB approaches each have a shared left-turn/through/right-turn lane. The existing SR 80 / James Ranch Road intersection lane geometry is shown in **Figure 2.1**. The area surrounding the SR 80 / James Ranch Road intersection is largely undeveloped. A single-family residence is located near the northeast corner of the intersection and some other structures exist to the east and west of the road south of SR 80.

The signalized intersection of ***SR 80 / US 191*** is located near milepost 364.7 along SR 80. The intersection is currently constructed as a four-legged intersection but functions as a three-legged T-intersection because the south leg is barricaded. As mentioned previously, the City of Douglas is planning to realign Chino Road by 2028 to tie into the currently barricaded south leg of the intersection of SR 80 / US 191. The EB and WB approaches to the intersection each have a left-turn lane, two through lanes, and a right-turn lane. The NB and SB approaches each have a left-turn lane and a shared through/right-turn lane. The existing SR 80 / US 191 intersection lane geometry is shown in **Figure 2.2**. Three quadrants of the SR 80 / US 191 intersection are undeveloped. The ADOT Commercial Inspection Facility and an ADOT Motor Vehicle Division Customer Service Center are located on the northeast corner of the intersection.

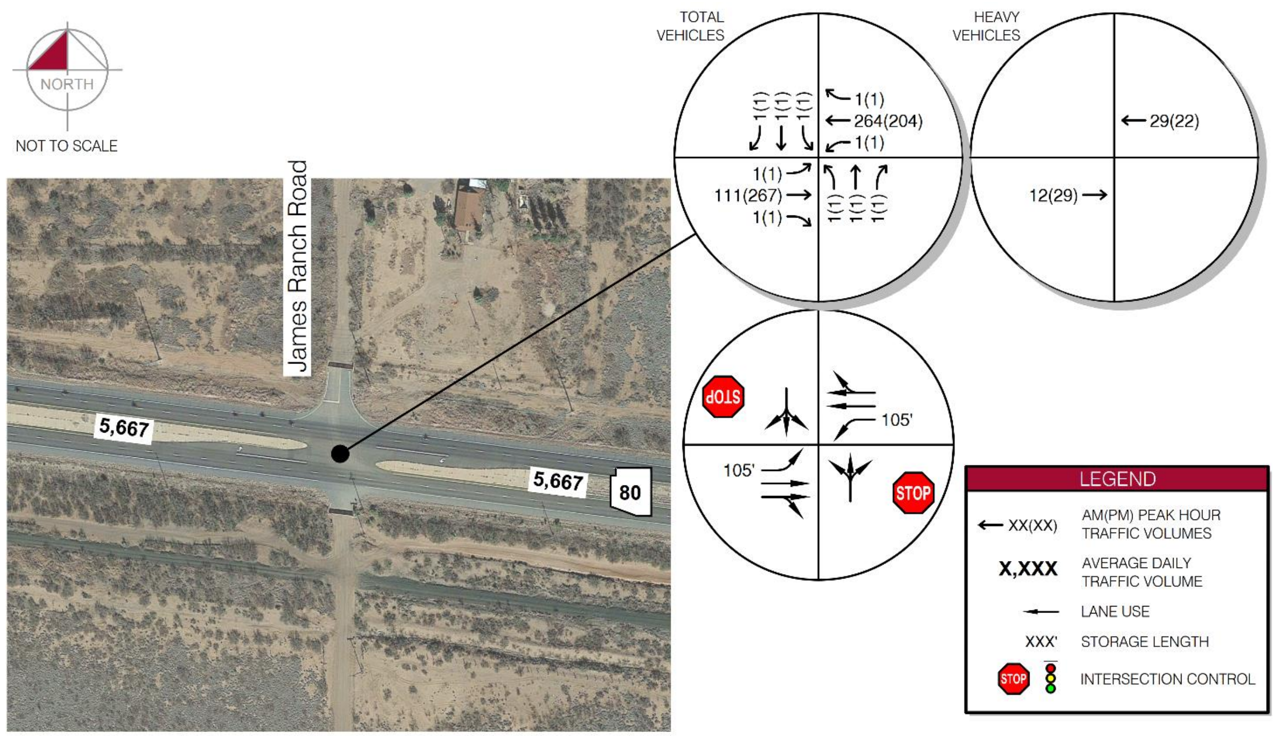


Figure 2.1 – Existing Conditions: SR 80 / James Ranch Road Intersection

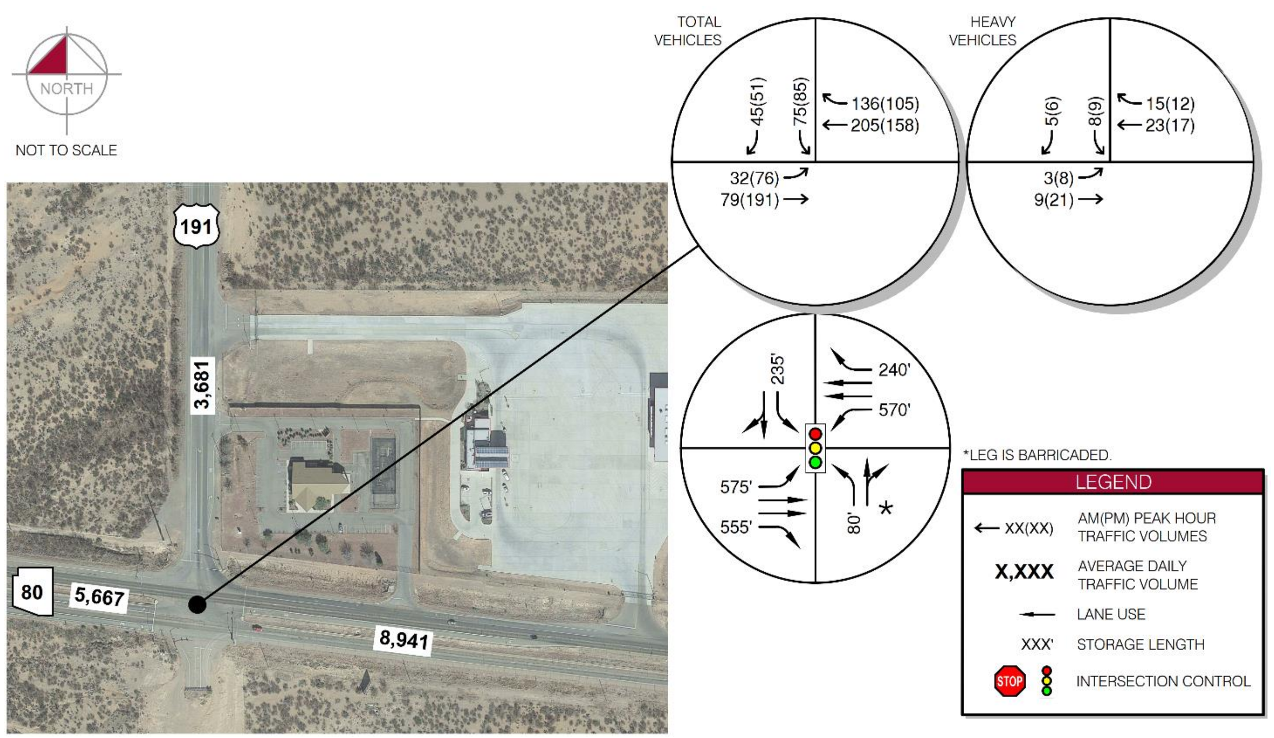


Figure 2.2 – Existing Conditions: SR 80 / US 191 Intersection

2.1.4 Transit and Active Transportation

The City of Douglas currently has bus routes that run along SR 80 between the RHC IPOE east of the study area and Cochise College, located approximately 2.5 miles west of James Ranch Road. Current pedestrian traffic is estimated to be very low along SR 80, US 191, and James Ranch Road in the study area due to the study area's distance from the City of Douglas, minimal adjacent development, and lack of pedestrian accommodations. Bicyclists are currently accommodated along SR 80 by the approximately ten-foot-wide paved outside shoulders in each travel direction.

2.2 Existing Ports of Entry

The existing RHC IPOE located along the U.S.-Mexico border at the southern terminus of US 191 Business (Pan American Avenue) is open from 9 AM to 5 PM daily. The RHC IPOE has seven lanes that process vehicular traffic entering the United States. One of these lanes is a designated Secure Electronic Network for Travelers Rapid Inspection (SENTRI) lane that allows expedited processing for pre-approved travelers. The number of dedicated commercial vehicle lanes varies, with a maximum of two lanes dedicated to commercial vehicles at a time. Per information provided by ADOT staff, all commercial vehicles entering the United States at the RHC IPOE are required to continue to the ADOT Commercial Inspection Facility on the northeast corner of the intersection of SR 80 / US 191 for additional processing before traveling to their ultimate destination. The RHC IPOE also has a facility east of the vehicle lanes to process pedestrian traffic. The facility has three booths for processing pedestrians; however, not all booths are open at all times.

The existing ADOT Commercial Inspection Facility on the northeast corner of the SR 80 / US 191 intersection is typically open the same hours as the RHC IPOE (9AM to 5PM daily). All inbound commercial vehicles from Mexico, as well as commercial vehicles traveling in both directions on US 191 and SR 80, are required to be processed at the ADOT Commercial Inspection Facility when it is open. The ADOT Commercial Inspection Facility has one driveway on SR 80 and one driveway on US 191. Internal site circulation follows a counterclockwise direction. Access at the SR 80 driveway is restricted to right-in/right-out movements due to the presence of the median on SR 80.

2.3 Existing Traffic Volumes and Operations

2.3.1 Truck Traffic at the Ports of Entry

Existing truck traffic volume data at the RHC IPOE was obtained from the Douglas Arizona Regional Feasibility Study prepared by Stantec in June 2018 (Stantec Study). The study obtained traffic data from the U.S. Customs and Border Patrol (CBP) collected from February 2017 to January 2018 for vehicles entering the United States. The collected vehicle data differentiated between passenger cars, also referred to as personally-owned vehicles (POVs), and trucks, also referred to as commercially-operated vehicles (COVs). The peak number of trucks processed at the RHC IPOE was 24 trucks per hour, with a total estimated demand of 31 trucks per hour. The truck volumes reported by the Stantec Study were utilized to represent anticipated truck volumes at the proposed commercial IPOE as detailed in Section 3.4.2 of this report.

ADOT provided 2021 and 2022 monthly statistics for processing of trucks at the ADOT Commercial Inspection Facility. This data indicates that truck volumes vary over time throughout the year but the data is not broken out by hour or direction of travel.

Relevant excerpts from the Stantec Study and ADOT annual volume data from the Douglas State POE are included in **Appendix 1** and **Appendix 2**, respectively.

2.3.2 Intersection and Roadway Traffic Volumes

Existing (2021) morning (AM) and afternoon (PM) peak period turning movement counts (TMCs) were estimated at the intersections of SR 80 / James Ranch Road and SR 80 / US 191 based on bi-directional average daily traffic (ADT) counts from the ADOT Transportation Data Management System (TDMS) and from the Southeastern Arizona Governments Organization (SEAGO) TDMS. Details regarding the ADOT and SEAGO counts are provided in **Appendix 3**.

The EB and WB through volumes at the intersection of SR 80 / James Ranch Road were estimated using the total AM and PM peak hour volumes from the ADOT TDMS counts. Existing volumes on James Ranch Road are anticipated to be very low due to the lack of development along the existing unpaved roadway. Therefore, a small volume was assumed on all movements other than the SR 80 mainline through traffic movements for the purposes of obtaining existing level of service (LOS) results.

Turning movement volumes at the existing intersection of SR 80 / US 191 were estimated based on the relative proportion of ADT volumes on each intersection leg.

The peak hour and ADT volumes at the existing intersections are shown in the previously referenced **Figure 2.1**. Existing traffic volume calculations are included in **Appendix 4**.

The EB and WB through volumes on SR 80 are heavily directional in the AM peak hour and moderately directional in the PM peak hour. The WB volumes are over 100 percent greater than the EB approach volumes in the AM peak hour, and the EB volumes are about 30 percent greater than the WB volumes in the PM peak hour. Daily EB and WB volumes on SR 80 are approximately equal.

Existing medium and heavy vehicle (truck) percentages along the study area roadways were obtained from the 2021 ADOT Average Annual Daily Traffic Reports.

Table 2.1 summarizes the existing ADT, K-factors (design peak hour percentage of daily volume), D-factors (directional split), T-factors (truck percentage), and percent medium and heavy vehicles (per the Federal Highway Administration [FHWA] 13-Class classification scheme detailed later in Section 7 of this report) obtained from the ADOT TDMS for the study area roadways. More information on existing TDMS traffic data can be found in **Appendix 3**.

Table 2.1 – Existing Traffic Data Summary

Input	SR 80 west of James Ranch Road	SR 80 / US 191			
		North Leg	South Leg	East Leg	West Leg
ADT (vpd)	5,667	3,681	-	8,941	5,667
K-Factor	9%	9%	-	8%	9%
D-Factor	59%	60%	-	54%	59%
T-Factor	11%	11%	-	11%	11%
Medium Vehicle %	6%	7%	-	9%	6%
Heavy Vehicle %	5%	4%	-	2%	5%

3. FUTURE TRAFFIC VOLUMES ANALYSIS AND ALTERNATIVES

3.1 Available Future Conditions Models and Data

Future conditions data was obtained from the following travel demand models:

- ADOT statewide model
- Sierra Vista Metropolitan Planning Organization (SVMPO) model

Upon initial analysis of both models, neither was found to adequately predict future traffic conditions within the study area. The ADOT statewide model has not been updated or calibrated for this area in many years and the model volumes and projected growth rates on SR 80 do not appear reasonable compared to existing counted volumes and expected growth rates. The SVMPO model extents are somewhat close to, but do not include, the study area. Information from the SVMPO model end links is not applicable as there are several roadway network connections between the edge of the SVMPO model and the study area. Therefore, neither travel demand model was used to determine future traffic conditions. The ADOT and SVMPO model outputs are included in **Appendix 3** for reference.

Instead of using model projections, 2040 annual average daily traffic (AADT) projections from the ADOT TDMS were used to calculate an average annual growth rate for the study roadway segments. Based on the existing and 2040 AADT projections, a growth rate of two percent per year was applied to the existing traffic volumes on SR 80 and US 191 to estimate opening year 2028 and horizon year 2050 daily and peak hour traffic volumes. Detailed volume calculations can be found in **Appendix 4**.

3.2 Future Build Analysis Alternatives

The following intersection configuration alternatives were analyzed at the study intersection of SR 80 / James Ranch Road under the opening year 2028 Build and horizon year 2050 Build conditions (see illustrations of the general intersection configurations, control types, and control locations shown in **Figure 3.1**):

- TWSC
- Traffic Signal Control
- Roundabout

The TWSC configuration assumes the existing northbound/southbound stop control on James Ranch Road remains; however, different lane geometry than existing was considered in the future analyses. The traffic signal control configuration assumes the installation of a traffic signal at the study intersection. The roundabout configuration assumes the installation of a two-lane roundabout at the study intersection.

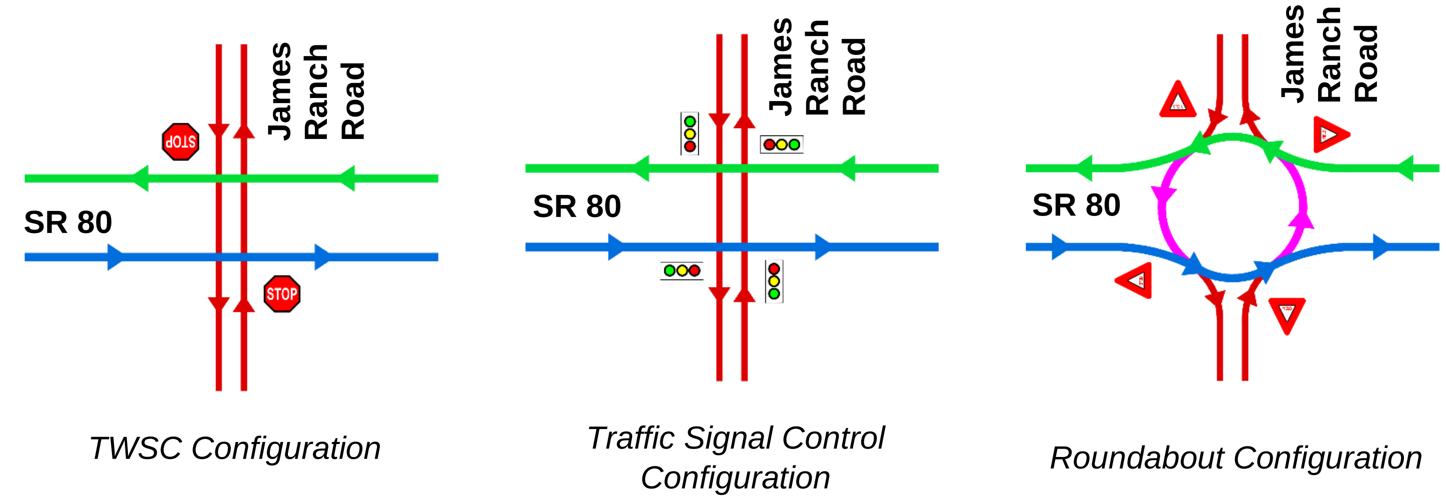


Figure 3.1 – Intersection Configuration Alternatives Analyzed

Additionally, the SR 80 / US 191 intersection was analyzed for all scenarios to identify how the intersection will be affected by the change in truck traffic routing from the proposed commercial IPOE and other traffic growth. The intersection was analyzed with its current lane geometry in the existing and 2028/2050 No-Build scenarios. The Chino Road re-route described in Section 2.1.2 was assumed to occur in the 2028/2050 Build scenarios; therefore, the currently-barricaded south leg of the intersection was analyzed as being open in these scenarios.

3.3 Future Land Use Forecast

The parcels along the James Ranch Road alignment south of SR 80 are zoned as "C-Developing" by Cochise County and are anticipated to contain commercial and/or industrial land uses. Because no detailed land use plans were available at the time of this report, it was assumed that the parcels fronting James Ranch Road and a portion of other parcels near James Ranch Road will contribute traffic to the proposed connector road. The parcels that were assumed to contribute to traffic on James Ranch Road are shown in **Figure 3.2**. It was assumed that all traffic from the parcels outlined in green and 30 percent of all traffic from the parcels outlined in blue would utilize James Ranch Road to get to and from SR 80. To estimate a leasable floor area for each parcel, a floor-area ratio (FAR) of 0.25 was assumed for all parcels. Additionally, it was assumed that 30 percent of the total adjacent parcel area would be developed by opening year 2028 and 100 percent of the total adjacent parcel area would be developed by horizon year 2050.

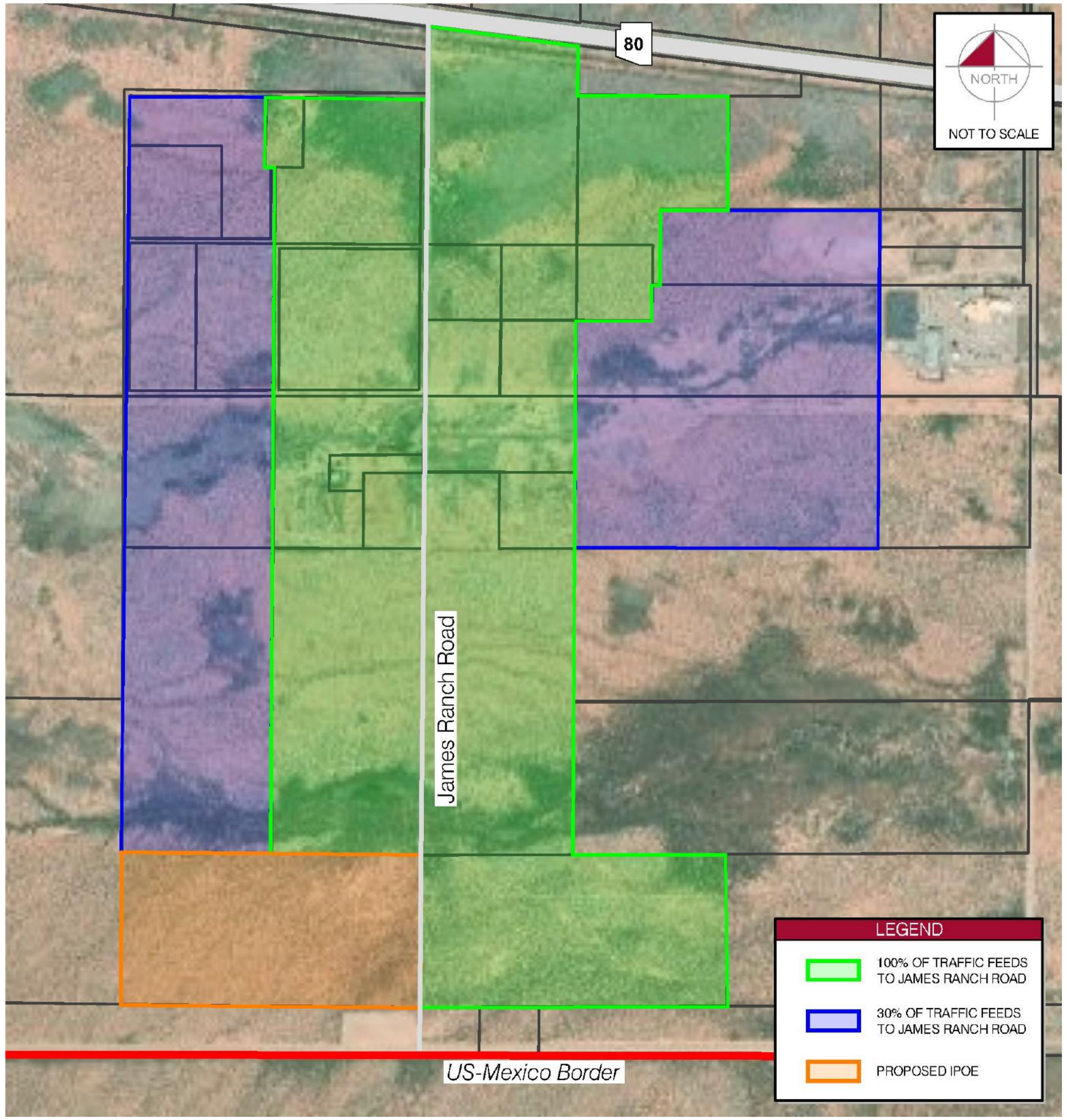


Figure 3.2 – Adjacent Parcel Area Assumptions

3.4 Future Traffic Volumes

3.4.1 Growth of Existing Traffic

Existing traffic on SR 80 and US 191 was grown based on a comparison of the existing and 2040 projected ADT volumes from the ADOT TDMS. From these volumes, an average annual growth rate of two percent per year was determined. This rate was applied to the existing volumes along SR 80, US 191, and Chino Road to obtain opening year 2028 and horizon year 2050 traffic volumes. Like the existing conditions analysis, a small traffic volume was also assumed for movements at the study intersections that are not anticipated to be affected by development on James Ranch Road south of SR 80. This assumed volume was increased in each successive analysis year to account for potential growth.

3.4.2 Proposed Commercial IPOE Traffic Volumes

Future volumes generated by the proposed commercial IPOE were estimated based on the existing traffic count data collected at the RHC IPOE from the Stantec Study previously described in Section 2.2. The study utilized the peak volume day of the 90th percentile peak volume week to determine daily and hourly passenger vehicle and heavy vehicle volumes. From this data, a daily heavy vehicle peak hour volume was determined, and a demand factor of 1.3 was applied to account for additional traffic demand that arrived within the peak hour but was not processed. The same peak hour heavy vehicle demand volume was assumed for the proposed commercial IPOE's trip generation for both trips entering and exiting the United States during both the AM and PM peak hours and represents a conservative estimate of expected traffic. Relevant excerpts from the Stantec Study are included in **Appendix 1**.

The proposed commercial IPOE trip generation was then distributed to the roadway network based on existing and anticipated traffic patterns in the study area. It is anticipated that all truck traffic entering the U.S. will be required to travel to the ADOT Commercial Inspection Facility located on the northeast corner of the intersection of SR 80 / US 191 for additional processing. Therefore, traffic entering the U.S. was first routed to the ADOT Commercial Inspection Facility before being distributed east and west along SR 80 and north on US 191. Entering and exiting traffic was distributed based on existing and anticipated traffic patterns on SR 80 and US 191.

The proposed commercial IPOE traffic assignment was grown based on the average annual growth rate used in the Stantec Study. The Stantec Study analyzed historical inbound volumes processed at the RHC IPOE between 2011 and 2017 and calculated an average annual growth rate of 1.1 percent per year. The proposed commercial IPOE traffic was assumed to grow at this annual rate to the opening year 2028 and horizon year 2050. Future traffic volume calculations for the proposed commercial IPOE are included in **Appendix 4**.

3.4.3 Adjacent Development Traffic Volumes

Volumes were estimated for the future developments along James Ranch Road south of US 80 using the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th Edition*. Trip generation was calculated using the "peak hour of generator" rates for ITE Land Use 150, Warehousing, to provide an estimate of peak hour traffic that could be generated by the future developments. The land use assumptions for the parcels anticipated to contribute traffic to the connector road are described previously in Section 3.3.

These adjacent development trips were distributed to the roadway network based on anticipated traffic patterns to and from the developments. Because most peak hour trips to and from warehousing land uses are commuters to and from residential areas, traffic is anticipated to be weighted heavily in the direction of Douglas. Therefore, it was estimated that 85 percent of traffic would travel to and from the east and 15 percent of traffic would travel to and from the west on SR 80. Trip generation calculations for the adjacent developments are shown in **Appendix 4**.

Heavy vehicle/truck percentages for the adjacent development traffic assignment were estimated based on Appendix I of the ITE *Trip Generation Handbook, 3rd Edition* and a comparison of the heavy vehicle and total vehicle trip generation rates in the ITE *Trip Generation Manual*. Based on these data, 20 percent of trips to and from the adjacent developments were assumed to be heavy vehicles.

3.4.4 Future Volumes and Lane Configuration Summary

The calculated average annual growth rates discussed in Section 3.4.1 were applied to the existing traffic volumes to obtain traffic volumes for the opening year 2028 and horizon year 2050 No-Build scenarios. The No-Build scenarios assume that the proposed commercial IPOE and the future warehousing developments along James Ranch Road are not constructed and that no changes are made to existing roadway geometry.

To determine future Build condition traffic volumes, the existing traffic volumes and the proposed commercial IPOE volumes were grown by the average annual growth rates discussed in Section 3.4.1 and Section 3.4.2, respectively. The grown existing volumes, the adjacent development volumes discussed in Section 3.4.3, and the grown proposed commercial IPOE traffic volumes were added together to obtain the total traffic volumes for the opening year 2028 and horizon year 2050 Build scenarios. In addition to the geometric improvements of the future Build analysis alternatives, the Build condition assumes that the Chino Road re-route described in Section 2.1.2 is completed by 2028.

The resultant 2028 and 2050 traffic volumes and lane configurations for the different SR 80 / James Ranch Road intersection configurations and for the SR 80 / US 191 intersection are presented in the following figures:

SR 80 / James Ranch Road:

- 2028 No-Build – **Figure 3.3**
- 2028 Build – **Figure 3.4**
- 2050 No-Build – **Figure 3.5**
- 2050 Build – **Figure 3.6**

SR 80 / US 191:

- 2028 No-Build – **Figure 3.7**
- 2028 Build – **Figure 3.8**
- 2050 No-Build – **Figure 3.9**
- 2050 Build – **Figure 3.10**

Table 3.1 and **Table 3.2** summarize the opening year 2028 and horizon year 2050 ADTs, K-factors, D-factors, and T-factors for each leg of the SR 80 / James Ranch Road and SR 80 / US 191/Chino Road intersections, respectively.

Table 3.1 – SR 80 / James Ranch Road Future Traffic Summary

Input	North Leg	South Leg	East Leg	West Leg
2028 ADT (vpd)	300	6,300	13,200	8,000
2050 ADT (vpd)	700	19,200	30,500	14,100
AM (PM) K-Factor	9% (9%)	9% (9%)	7% (8%)	7% (8%)
D-Factor	50%	55%	51%	56%
2028 T-Factor	2%	30%	21%	18%
2050 T-Factor	2%	24%	20%	17%

Table 3.2 – SR 80 / US 191/ Chino Road Future Traffic Summary

Input	North Leg	South Leg	East Leg	West Leg
2028 ADT (vpd)	6,900	3,500	11,900	12,600
2050 ADT (vpd)	11,900	5,400	28,000	29,500
AM (PM) K-Factor	6% (8%)	7% (7%)	7% (8%)	6% (7%)
D-Factor	56%	63%	57%	50%
2028 T-Factor	27%	5%	15%	23%
2050 T-Factor	24%	5%	17%	21%

Note that the K-factors used in the future analysis differ from the existing K-factors from the ADOT TDMS. For the future volumes analysis, these values were recalculated from the hourly TDMS volume data for both the AM and PM peak hours separately to provide an estimate that better reflects the available data for future traffic conditions. Additionally, T-factors were applied per turning movement instead of per approach in the analysis. The approach T-factors reported above represent the weighted average truck percentages by movement volume and are provided for reference.

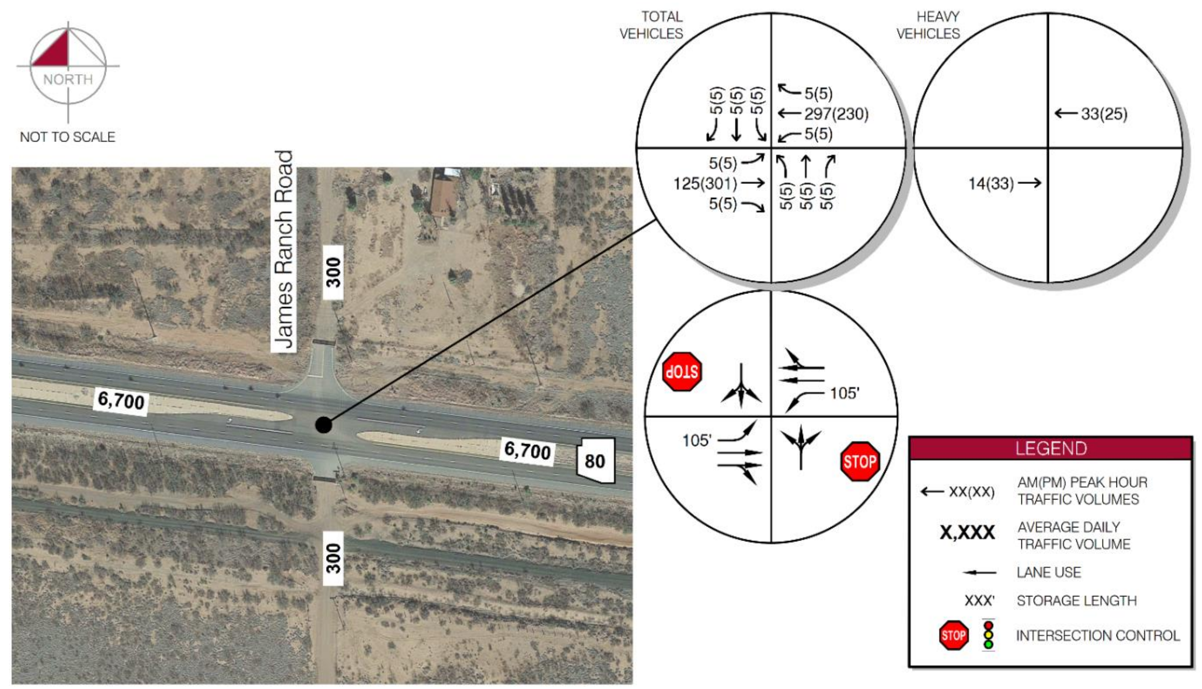


Figure 3.3 – SR 80 / James Ranch Road: 2028 No-Build Traffic Volumes & Lane Configuration

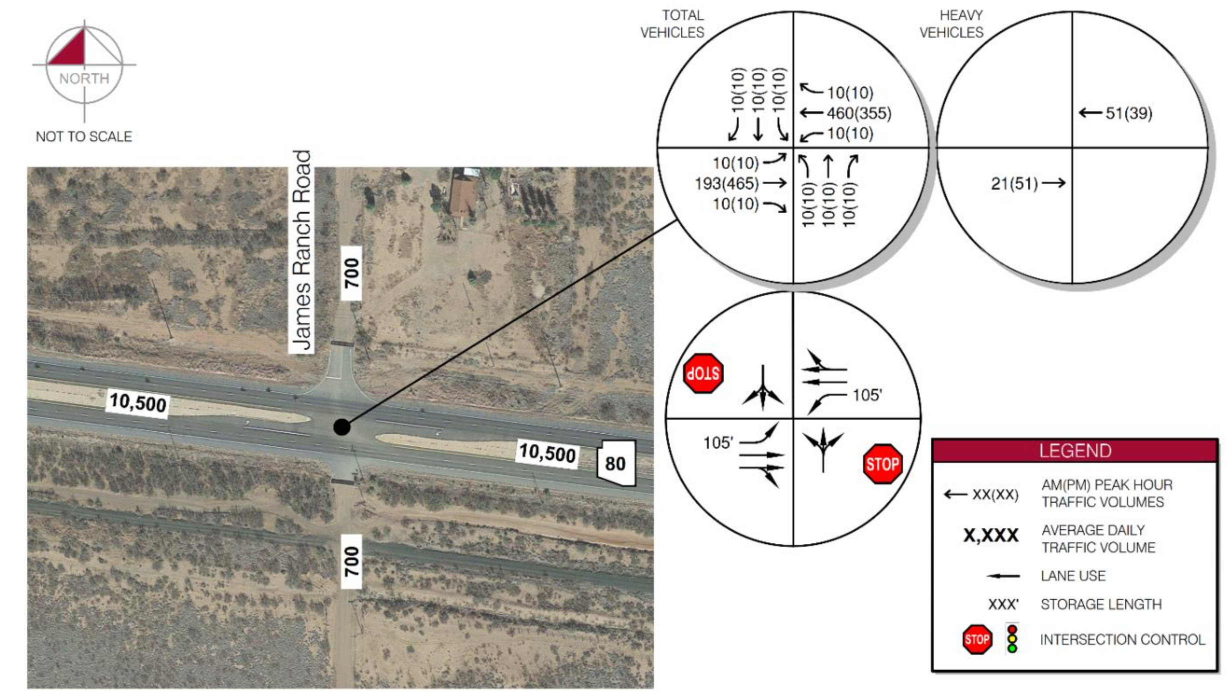


Figure 3.5 – SR 80 / James Ranch Road: 2050 No-Build Traffic Volumes & Lane Configuration

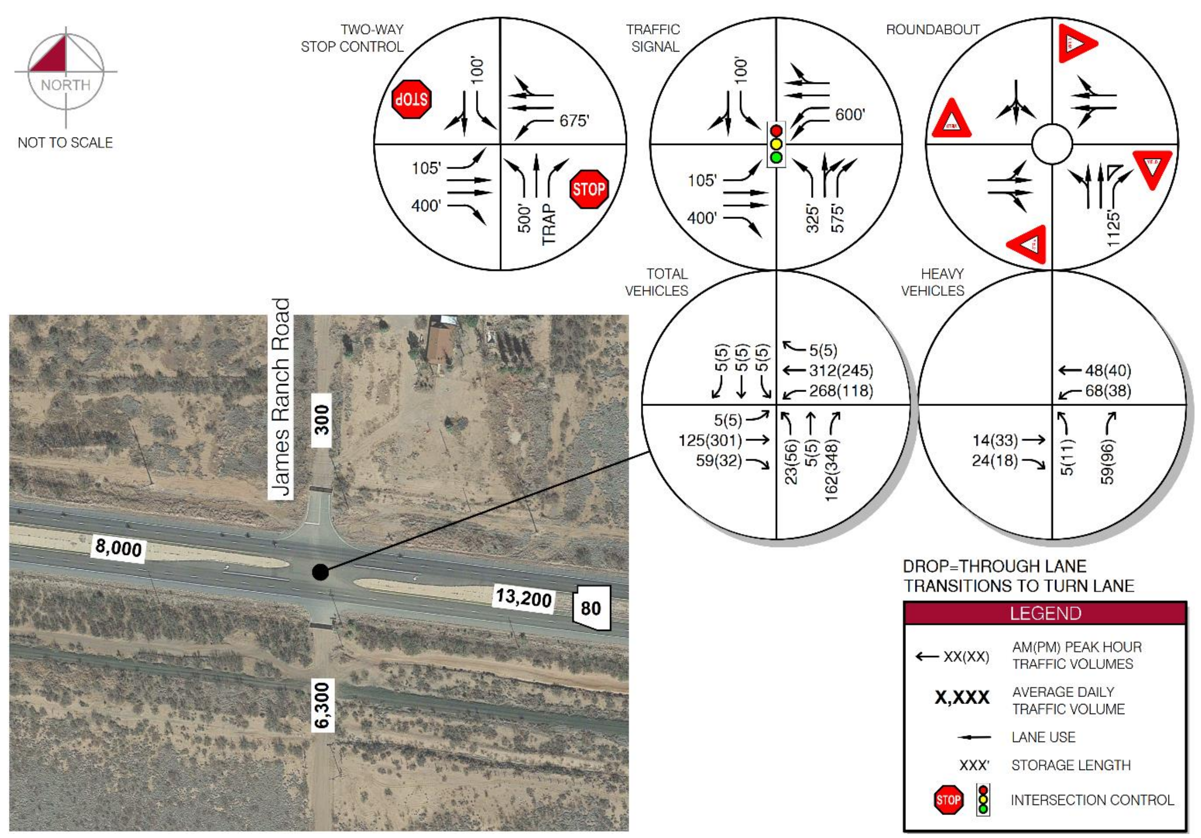


Figure 3.4 – SR 80 / James Ranch Road: 2028 Build Traffic Volumes & Lane Configuration

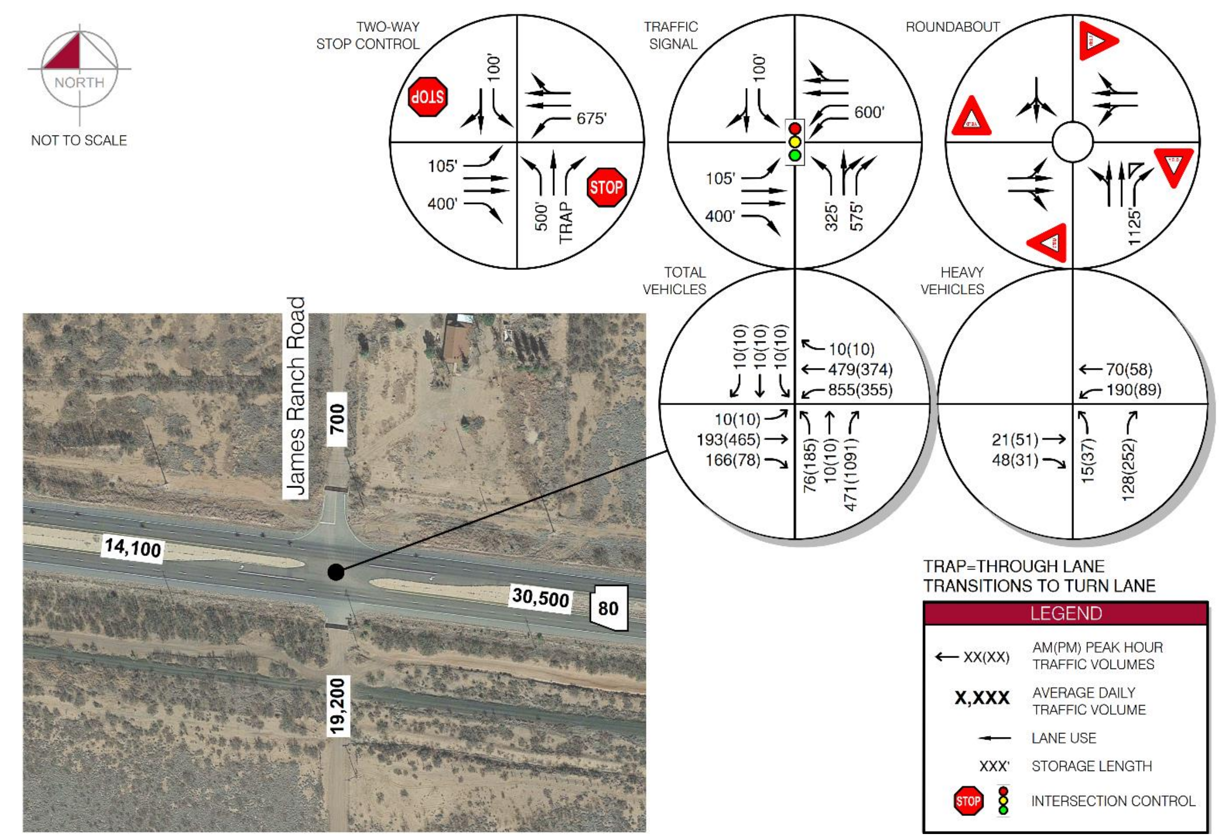


Figure 3.6 – SR 80 / James Ranch Road: 2050 Build Traffic Volumes & Lane Configuration

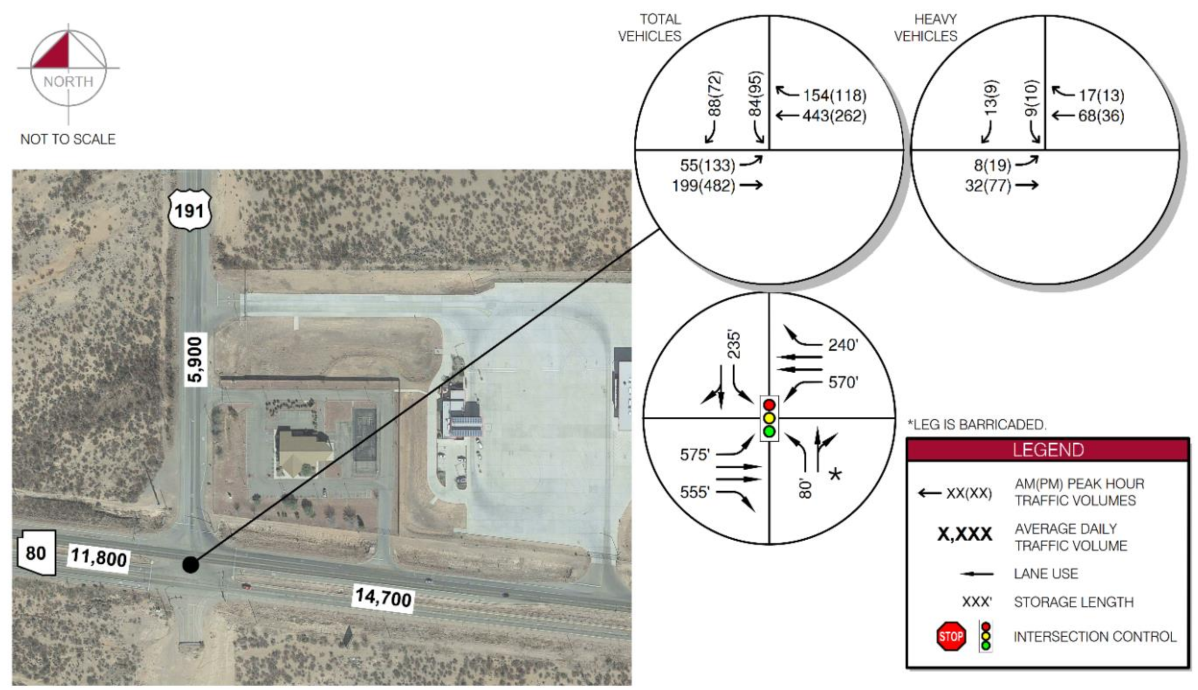


Figure 3.7 – SR 80 / US 191: 2028 No-Build Traffic Volumes & Lane Configuration

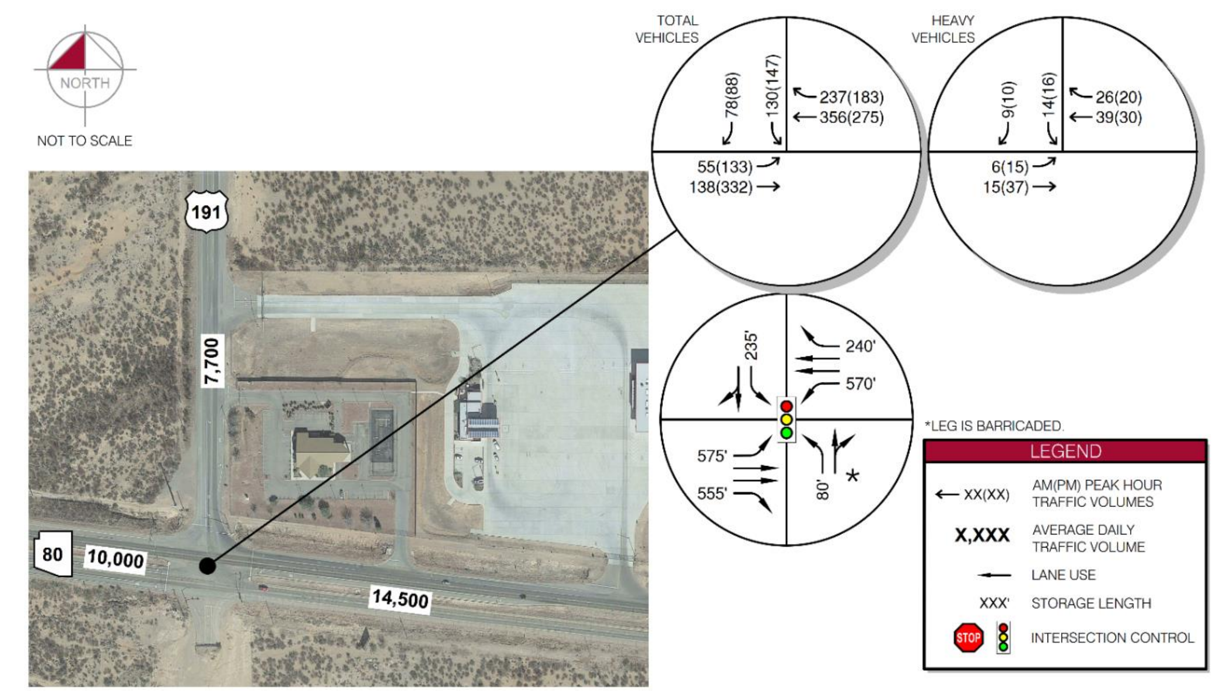


Figure 3.9 – SR 80 / US 191: 2050 No-Build Traffic Volumes & Lane Configuration

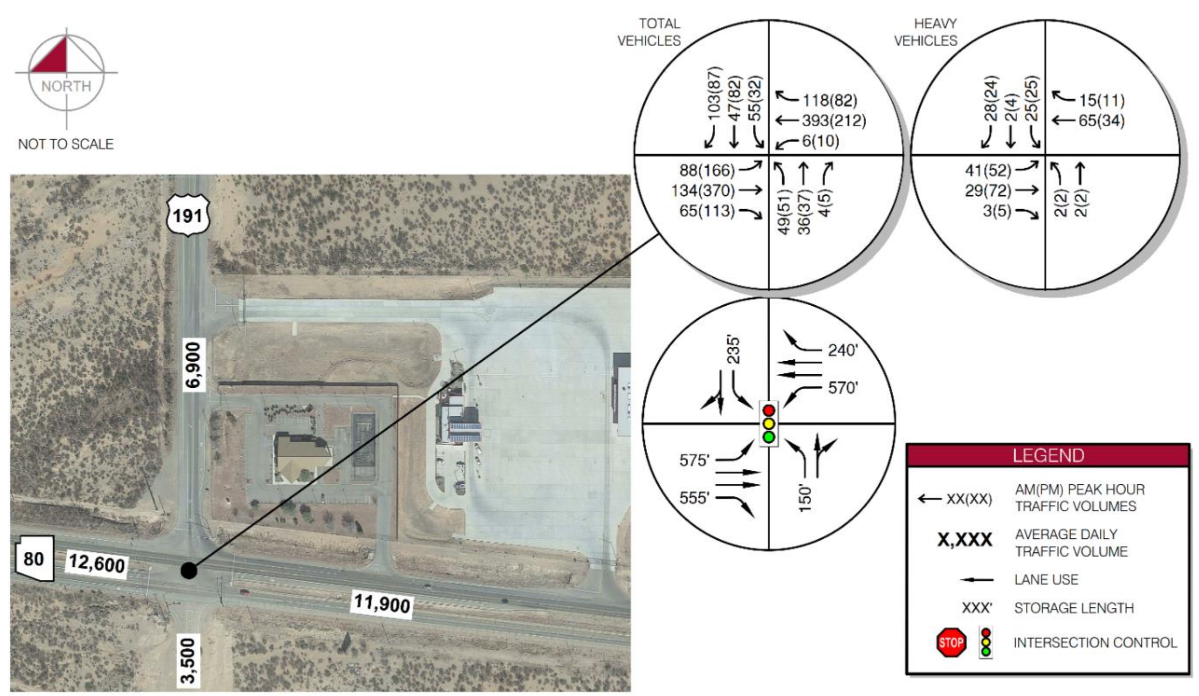


Figure 3.8 – SR 80 / US 191: 2028 Build Traffic Volumes & Lane Configuration

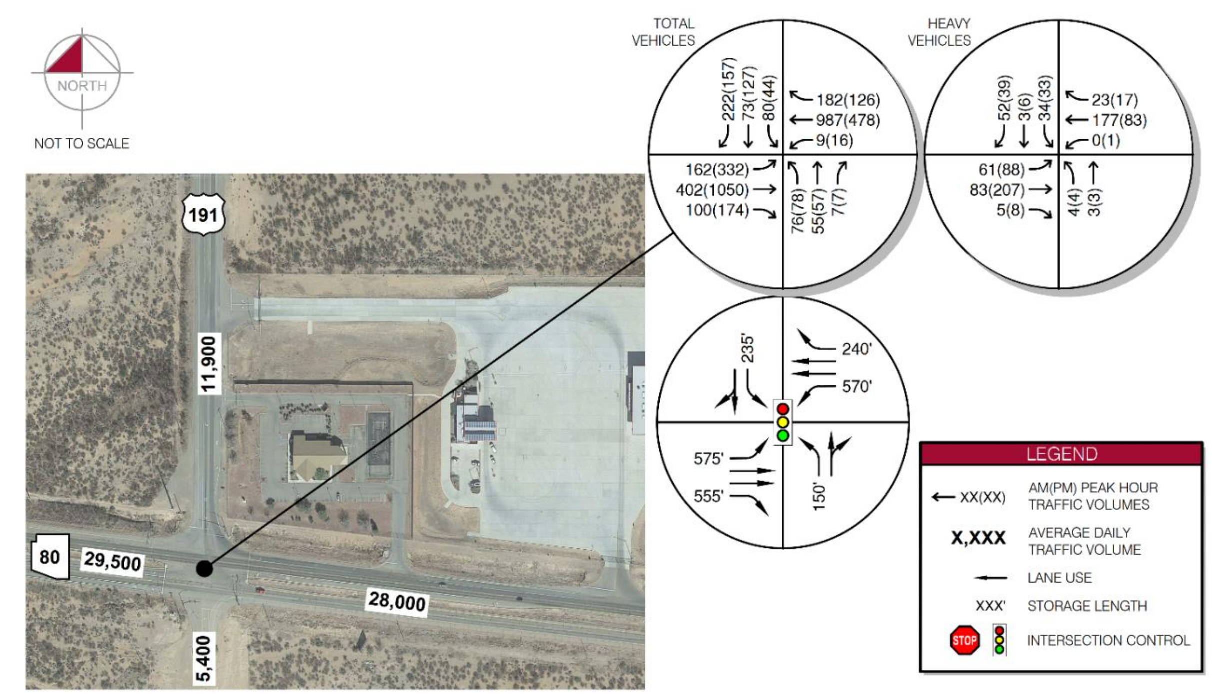


Figure 3.10 – SR 80 / US 191: 2050 Build Traffic Volumes & Lane Configuration

The recommended storage lengths shown in **Figure 3.4** through **Figure 3.10** were determined using the methodology outlined in ADOT Traffic Guidelines and Processes (TGP) Section 430. Tables 430-1 and 430-2 from the TGP were used to select an appropriate gap and braking distance, respectively. The 95th percentile queues from the different operational analyses presented in Section 5 of this report were used as the queue portion of the storage described in TGP 430.

Per ADOT TGP 245, an exclusive EB right-turn lane is warranted at the intersection of SR 80 / James Ranch Road based on projected 2028 and 2050 peak hour turning movement volumes.

Relevant excerpts from TGP 430 and TGP 245 are included in **Appendix 5**.

4. CRASH SUMMARY

A crash summary was conducted for crashes occurring along SR 80 between approximately 1,5 miles west of James Ranch Road and 1.0 mile east of James Ranch Road to identify any crash patterns or trends that may be present within the study area.

Crash data was obtained from ADOT for the dates between January 1, 2017 and December 31, 2021, the five most current full years available.

Nineteen total crashes were reported along this SR 80 study segment. Of the 19 total crashes, there were two angle crashes (11 percent of total crashes). One angle crash occurred at the driveway on SR 80 approximately 1.5 miles west of James Ranch Road and the other occurred at the intersection of SR 80 / Kings Highway (1.0 mile east of James Ranch Road). The crash reported west of James Ranch Road resulted in a suspected serious injury, while the crash east of James Ranch Road resulted in no injury.

The remaining 17 crashes were all single-vehicle crashes along SR 80 (89 percent of total crashes). Of these crashes, 12 crashes involved an animal, 3 crashes involved an object, and 2 crashes were rollovers. Of the single-vehicle crashes, 13 crashes resulted in no injuries, 2 crashes resulted in possible injury, and 2 crashes resulted in suspected minor injury.

Overall, 12 of the 19 total crashes occurred in dark, not lighted conditions (63 percent), 1 occurred during dusk (5 percent), 1 occurred in dark, lighted conditions (5 percent), and 5 occurred in daylight (27 percent). This may indicate lighting issues on SR 80.

Summaries of the total crashes and crash severity by year are shown in **Figure 4.1** and **Figure 4.2**, respectively. **Figure 4.3** shows the locations of all crashes within the study period by injury severity. Note that in these figures, the crash type of one crash is classified as "other". This crash was described as occurring with an "other non-fixed object" and was therefore included as a single-vehicle crash for the purposes of this analysis.

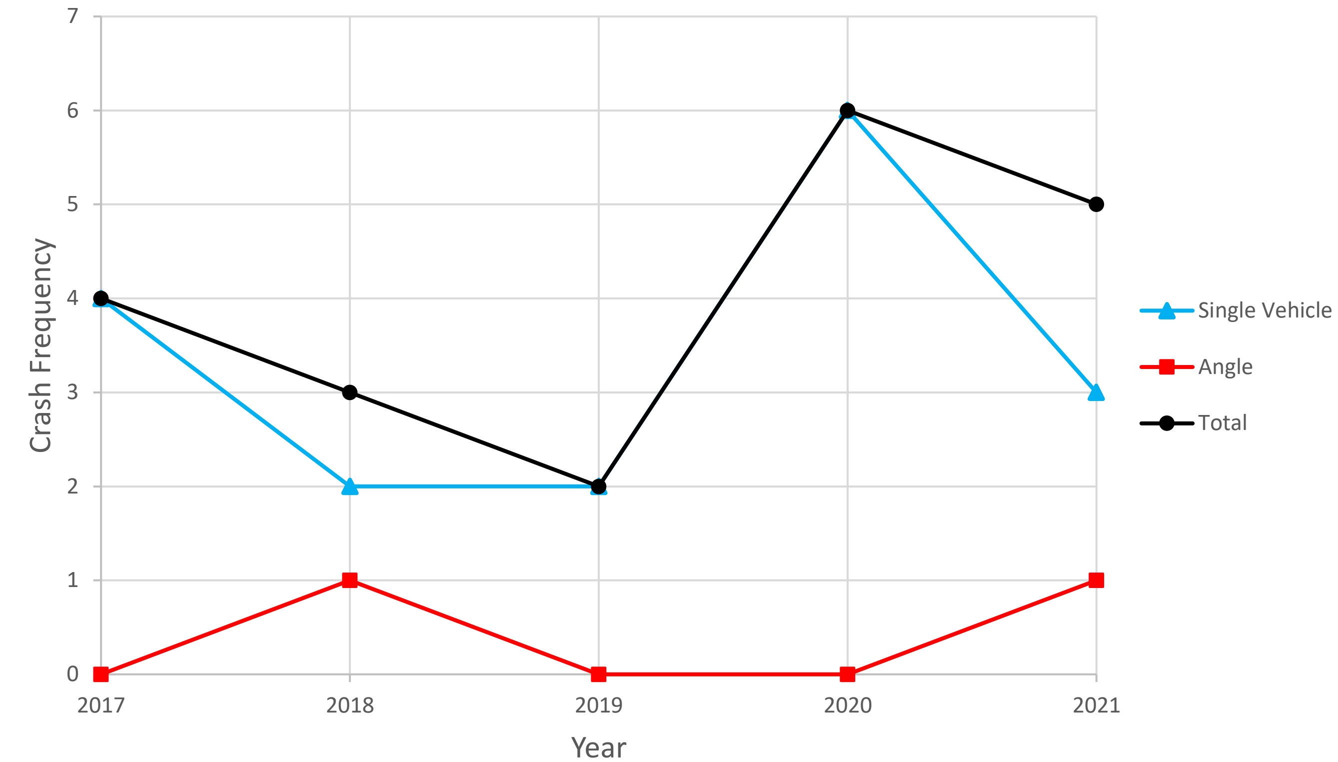


Figure 4.1 – Crash Type by Year

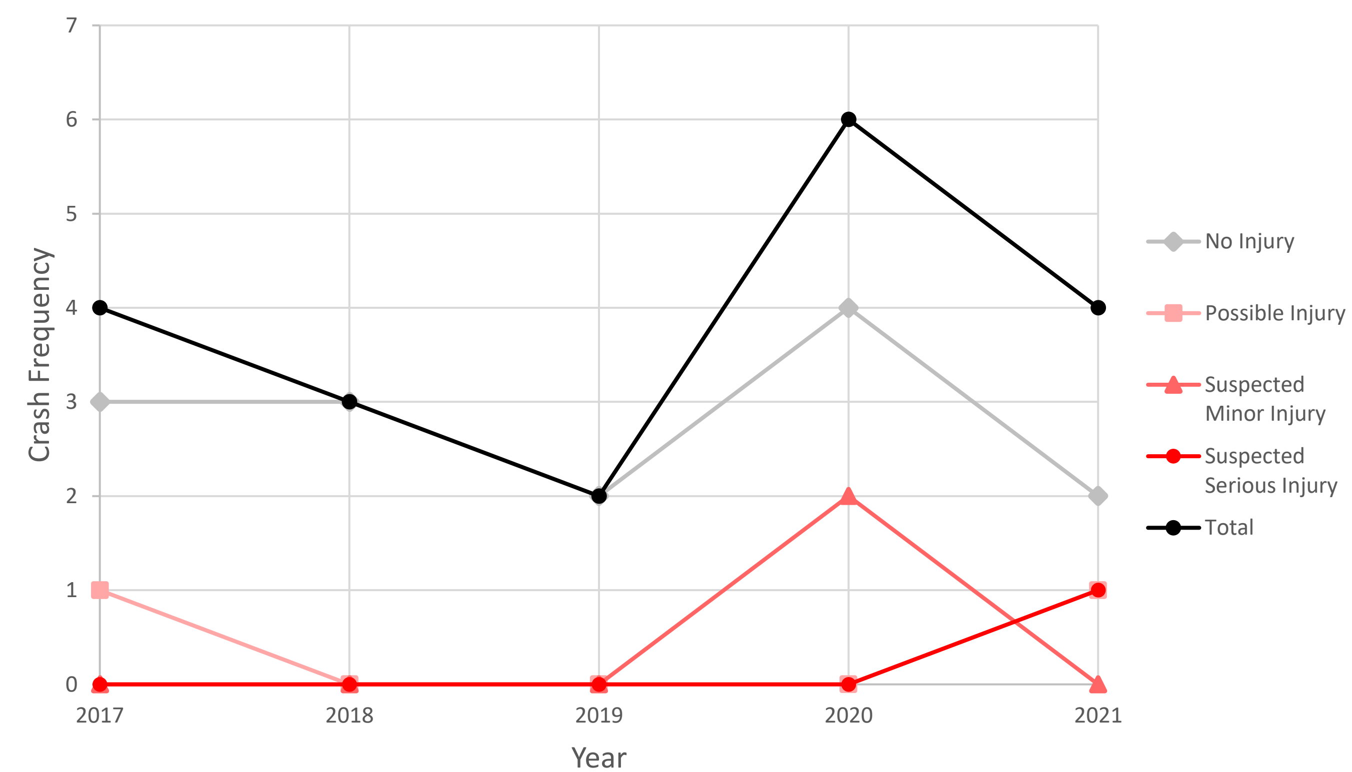
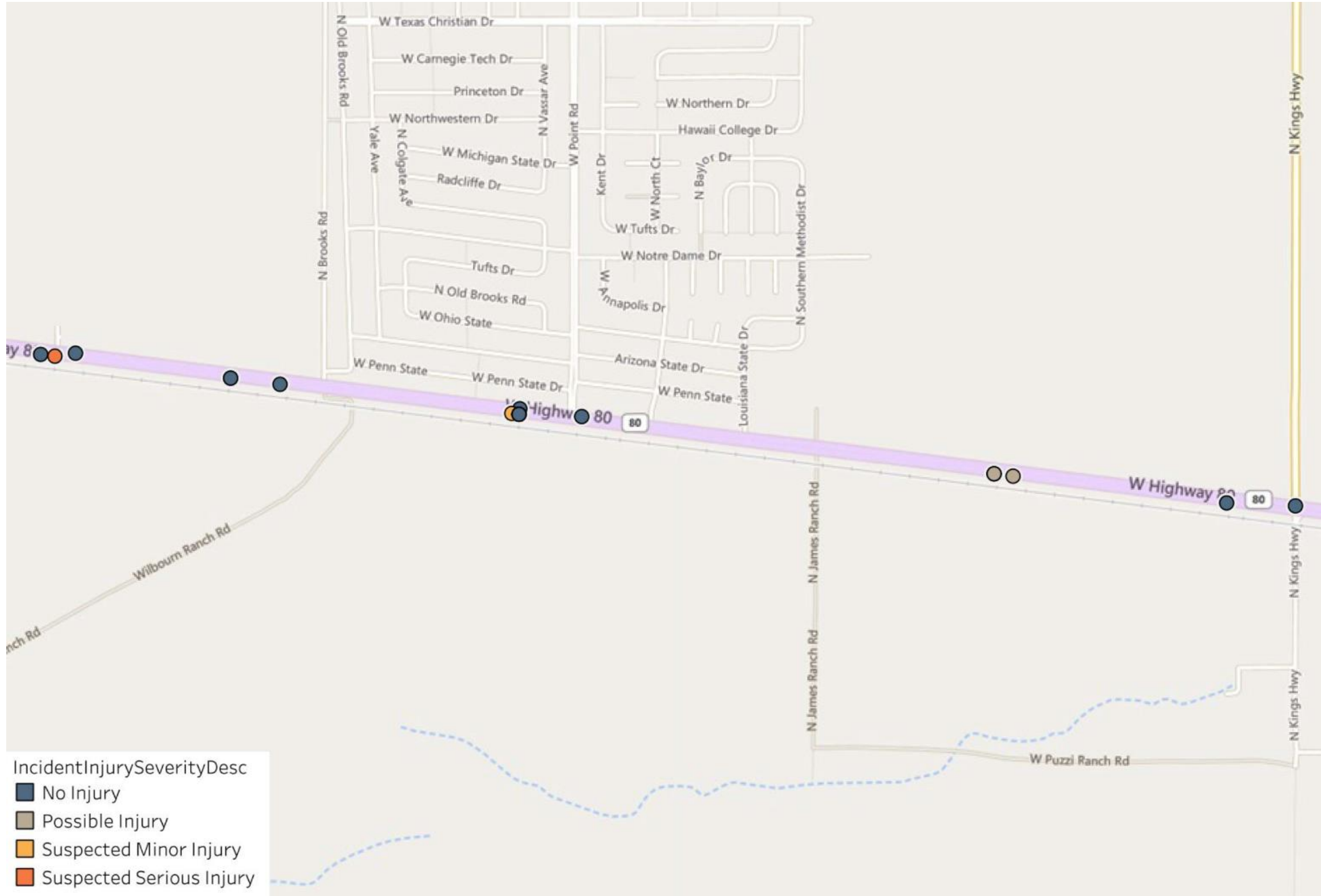


Figure 4.2 – Crash Severity by Year



Source: ADOT

Figure 4.3 – Crash Map

5. OPERATIONAL ANALYSIS

5.1 Intersection Analysis Methodology

An intersection operational analysis was performed at the intersections of SR 80 / James Ranch Road and SR 80 / US 191 for the Existing, 2028 No-Build, 2050 No-Build, 2028 Build, and 2050 Build conditions (for the previously mentioned potential intersection configuration alternatives). The level of service (LOS) and queueing analyses for the TWSC and traffic signal control alternatives were completed using the Highway Capacity Manual, 6th Edition (HCM 6) methodology via Synchro 11 analysis software. Existing signal timing data provided by ADOT at the SR 80 / US 191 intersection were used in the existing and future analyses. The analysis of the Roundabout alternative was completed using Rodel 1.96 analysis software.

Each intersection, approach, or movement is given a letter designation from LOS A to LOS F. LOS A represents operational conditions with minimal delay and traffic volumes significantly less than available capacity (volume-to-capacity ratio [v/c] < 1). LOS F represents poor operational conditions with a high degree of delay and/or traffic volumes greater than the available capacity (v/c >1). Each LOS grade represents a range of operational conditions. **Table 5.1** shows the average vehicle delay ranges for signalized and unsignalized intersections (including roundabouts) that correspond with each LOS letter grade. Note that the HCM methodology does not provide an overall intersection LOS for TWSC intersections.

Table 5.1 – Level of Service Thresholds for Signalized and Unsignalized Intersections

Level of Service	Control Delay (s/veh)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80 or v/c > 1.0*	> 50 or v/c > 1.0*

*v/c = volume-to-capacity ratio
Source: HCM 6th Edition

The existing peak hour factors (PHF) were adjusted in all future analysis scenarios based on the projected traffic demand and proposed lane geometry in accordance with the following guidelines from the ADOT TGP Section 240 for future PHFs:

- PHF = 0.80 for < 75 vehicles per hour (vph) per lane
- PHF = 0.85 for 75 - 300 vph per lane
- PHF = 0.90 for > 300 vph per lane

5.2 Existing Intersection Conditions

The existing LOS, delay, and 95th percentile queues at the study area intersections were evaluated using the existing traffic volumes and lane geometry described previously in Section 2. The SR 80 / US 191 intersection was analyzed using current signal timings provided by ADOT. Existing signal timing inputs are provided in **Appendix 6**. The results of the Existing AM and Existing PM intersection capacity analyses are shown in **Table 5.2** and **Table 5.3**, respectively. Synchro output reports for the Existing analysis scenarios are provided in **Appendix 7**.

Table 5.2 – Existing Intersection Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS	B			B			A	-		A	-		
Average Delay (s)	11			11			8	-		8	-		
95th Percentile Queue (ft)	0			0			0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				11		10	6	5			6	7	7
95th Percentile Queue (ft)				25		25	25	25			25	25	-

All movements at the study area intersections under existing conditions operate at LOS B or better in the AM peak hour with reported 95th percentile queues no greater than 25 feet long.

Table 5.3 – Existing Intersection Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS	B			B			A	-		A	-		
Average Delay (s)	11			11			8	-		8	-		
95th Percentile Queue (ft)	0			0			0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				11		10	7	6			6	6	7
95th Percentile Queue (ft)				25		25	25	25			25	25	-

All movements at the study area intersections under existing conditions operate at LOS B or better in the PM peak hour with reported 95th percentile queues no greater than 25 feet long.

5.3 No-Build Intersection Analysis

The 2028 and 2050 No-Build LOS, delay, and 95th percentile queues at the study area intersections were evaluated using the 2028 and 2050 No-Build volumes and the existing geometry described previously in Section 2. The No-Build scenarios assume existing lane geometry, including the existing Chino Road alignment, and do not include proposed commercial IPOE or warehousing traffic volumes. The results of the 2028 No-Build AM, 2028 No-Build PM, 2050 No-Build AM and 2050 No-Build PM intersection capacity analyses are shown in **Table 5.4**, **Table 5.5**, **Table 5.6**, and **Table 5.7**, respectively. The Synchro output reports for the No-Build scenarios are provided in **Appendix 7**.

Table 5.4 – 2028 No-Build Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS		B			B		A	-		A	-		
Average Delay (s)		12			12		8	-		8	-		
95th Percentile Queue (ft)		25			25		0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				11		11	7	5			6	7	7
95th Percentile Queue (ft)				25		25	25	25			25	25	-

All movements at the study area intersections are expected to operate at LOS B or better in the 2028 No-Build scenario in the AM peak hour with 95th percentile queues no greater than 25 feet long.

Table 5.5 – 2028 No-Build Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS		B			B		A	-		A	-		
Average Delay (s)		13			12		8	-		9	-		
95th Percentile Queue (ft)		25			25		0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				11		11	7	6			6	7	7
95th Percentile Queue (ft)				25		25	25	25			25	25	-

All movements at the study area intersections are expected to operate at LOS B or better in the 2028 No-Build scenario in the PM peak hour with 95th percentile queues no greater than 25 feet long.

Table 5.6 – 2050 No-Build Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS		B			C		A	-		A	-		
Average Delay (s)		15			16		9	-		8	-		
95th Percentile Queue (ft)		25			25		0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				15		14	7	5			6	7	8
95th Percentile Queue (ft)				50		25	25	25			25	50	-

All movements at the study area intersections are expected to operate at LOS C or better in the 2050 No-Build scenario in the AM peak hour with 95th percentile queues no greater than 50 feet long.

Table 5.7 – 2050 No-Build Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
SR 80 / James Ranch Road													
LOS		C			C		A	-		A	-		
Average Delay (s)		20			18		8	-		9	-		
95th Percentile Queue (ft)		25			25		0	-		0	-		
SR 80 / US 191													
LOS				B		B	A	A			A	A	A
Average Delay (s)				16		15	8	5			5	6	8
95th Percentile Queue (ft)				50		50	25	25			25	25	-

All movements at the study area intersections are expected to operate at LOS C or better in the 2050 No-Build scenario in the PM peak hour with 95th percentile queues no greater than 50 feet long.

5.4 SR 80 / James Ranch Road Future Build Analysis

The 2028 and 2050 Build LOS, delay, and 95th percentile queues at the SR 80 / James Ranch Road intersection were evaluated using the 2028 and 2050 Build volumes and the TWSC, traffic signal control, and roundabout intersection configuration alternatives described previously in Section 3 of this report.

5.4.1 Two-Way Stop Controlled Intersection Capacity Analysis Results

An intersection diagram extracted from Synchro showing the TWSC lane geometry used in the 2028 and 2050 Build analyses is presented in **Figure 5.1**. The results of the 2028 Build AM, 2028 Build PM, 2050 Build AM and 2050 Build PM intersection capacity analyses with the TWSC configuration are shown in **Table 5.8**, **Table 5.9**, **Table 5.10**, and **Table 5.11**, respectively. The Synchro output reports for the TWSC configuration are provided in **Appendix 7**.

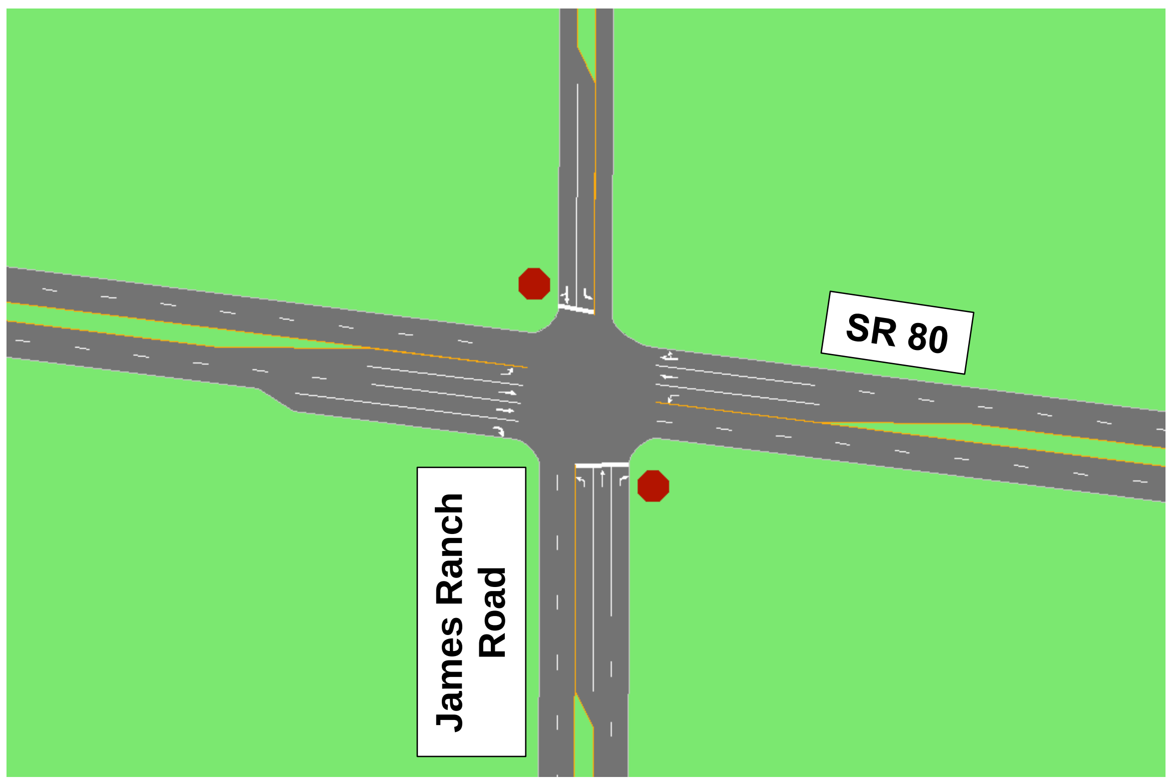


Figure 5.1 – SR 80 / James Ranch Road - TWSC Intersection Diagram

Table 5.8 – SR 80 / James Ranch Road - 2028 Build with TWSC Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach		
	L	T	R	L	T	R	L	T	R	L	T	R
LOS	E	D	B	E	C		A	-		A	-	
Average Delay (s)	38	32	10	43	22		8	-		9	-	
95th Percentile Queue (ft)	25	25	25	25	25		0	-		0	-	

The NB and SB left-turn movements at the SR 80 / James Ranch Road intersection are anticipated to operate at LOS E in the 2028 Build with TWSC scenario during the AM peak hour. All other movements are anticipated to operate at LOS D or better. All movements are anticipated to have 95th percentile queues no greater than 25 feet long.

Table 5.9 – SR 80 / James Ranch Road - 2028 Build with TWSC Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach		
	L	T	R	L	T	R	L	T	R	L	T	R
LOS	D	C	B	D	C		A	-		A	-	
Average Delay (s)	30	22	15	35	16		8	-		9	-	
95th Percentile Queue (ft)	50	25	75	25	25		0	-		25	-	

All movements at the SR 80 / James Ranch Road intersection are anticipated to operate at LOS D or better in the 2028 Build with TWSC scenario during the PM peak hour. All movements are anticipated to have 95th percentile queues no greater than 75 feet long.

Table 5.10 – SR 80 / James Ranch Road - 2050 Build with TWSC Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach		
	L	T	R	L	T	R	L	T	R	L	T	R
LOS	F	F	C	F	F		A	-		E	-	
Average Delay (s)	*	*	16	*	*		9	-		38	-	
95th Percentile Queue (ft)	*	75	125	*	125		0	-		400	-	

* Value not reported due to HCM limitations. Significant delays and queueing anticipated.

The NB and SB left-turn movements, the NB through movement, and the SB through/right-turn movement at the SR 80 / James Ranch Road intersection are anticipated to operate at LOS F in the 2050 Build with TWSC scenario during the AM peak hour. The WB left-turn movement is anticipated to operate at LOS E. All other movements at the study area intersections are anticipated to operate at LOS C or better. Significant queueing is expected on the NB and SB left-turn movements. The WB left-turn movement experiences a 95th percentile queue of 400 feet, which exceeds the existing storage length. All other movements are anticipated to have 95th percentile queues no greater than 125 feet long.

Table 5.11 – SR 80 / James Ranch Road - 2050 Build with TWSC Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach		
	L	T	R	L	T	R	L	T	R	L	T	R
LOS	F	F	F	F	F		A	-		B	-	
Average Delay (s)	*	133	*	*	88		8	-		14	-	
95th Percentile Queue (ft)	*	25	*	*	50		0	-		75	-	

* Value not reported due to HCM limitations. Significant delays and queueing anticipated.

The NB and SB left-turn movements, the NB through and right-turn movements, and the SB through/right-turn movement at the SR 80 / James Ranch Road intersection are anticipated to operate at LOS F in the 2050 Build with TWSC scenario during the PM peak hour. All other movements at the study area intersections are anticipated to operate at LOS B or better. Significant queueing is expected on the NB and SB left-turn movements and the NB right-turn movement. All other movements are anticipated to have 95th percentile queues no greater than 75 feet long.

5.4.2 Signalized Intersection Capacity Analysis Results

An intersection diagram extracted from Synchro showing the signalized intersection lane geometry used in the 2028 and 2050 Build analyses is presented in **Figure 5.2**. The results of the 2028 Build AM, 2028 Build PM, 2050 Build AM and 2050 Build PM intersection capacity analyses with the signalized configuration are shown in **Table 5.12**, **Table 5.13**, **Table 5.14**, and **Table 5.15**, respectively. The Synchro output reports for the signalized configuration are provided in **Appendix 7**.

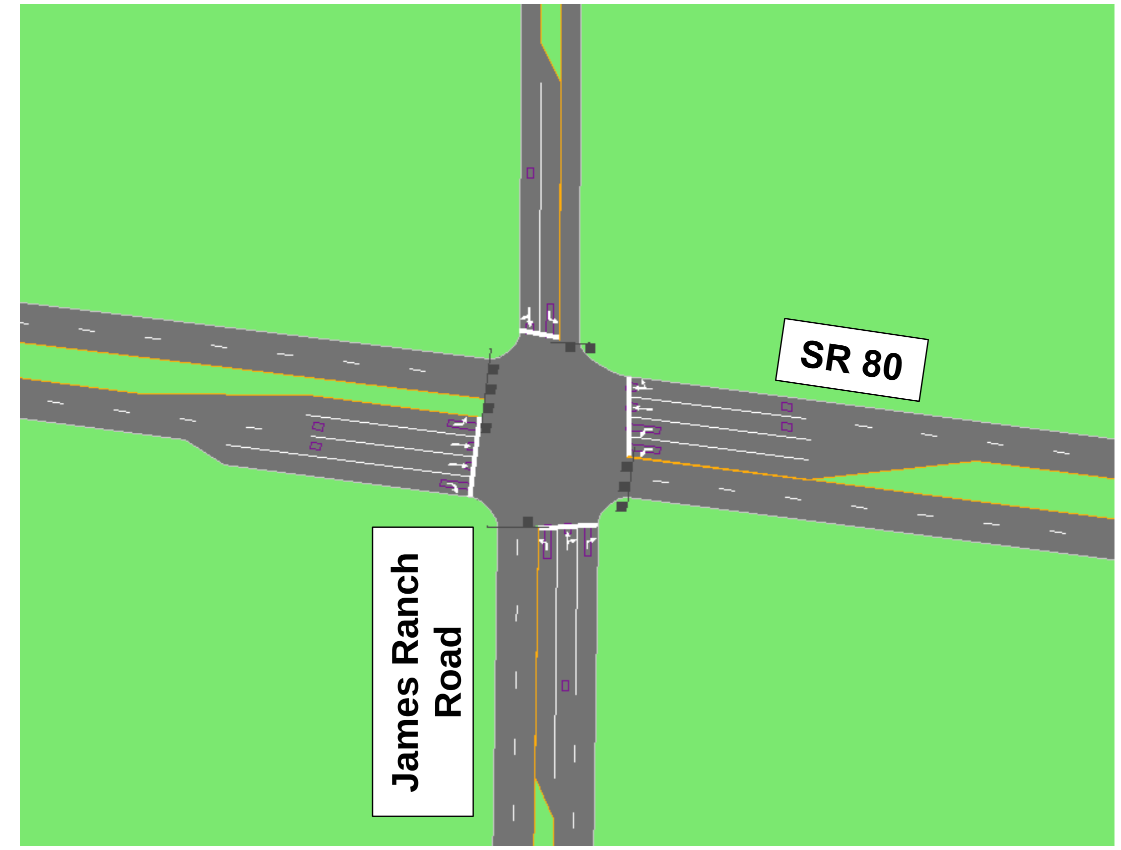


Figure 5.2 – SR 80 / James Ranch Road - Signalized Intersection Diagram

Table 5.12 – SR 80 / James Ranch Road - 2028 Build with Traffic Signal Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	B	B		B	B		A	B	B	A	A		A
Average Delay (s)	10	12		10	10		9	10	12	5	4		7
95th Percentile Queue (ft)	25	25		0	25		0	25	25	25	25		-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS A in the 2028 Build with traffic signal scenario during the AM peak hour. All movements are anticipated to operate at LOS B or better, with 95th percentile queues no greater than 25 feet long.

Table 5.13 – SR 80 / James Ranch Road - 2028 Build with Traffic Signal Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	B	B		A	A		B	B	B	A	A		B
Average Delay (s)	11	13		10	10		11	13	12	7	5		10
95th Percentile Queue (ft)	25	25		0	25		0	50	25	25	25		-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS B in the 2028 Build with traffic signal scenario during the PM peak hour. All movements are anticipated to operate at LOS B or better, with 95th percentile queues no greater than 50 feet long.

Table 5.14 – SR 80 / James Ranch Road - 2050 Build with Traffic Signal Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	C	C		B	B		C	C	C	D	A		C
Average Delay (s)	22	29		19	19		21	22	29	40	6		27
95th Percentile Queue (ft)	75	175		25	25		25	75	125	325	50		-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS C in the 2050 Build with traffic signal scenario during the AM peak hour. All movements are anticipated to operate at LOS D or better, with 95th percentile queues no greater than 325 feet long.

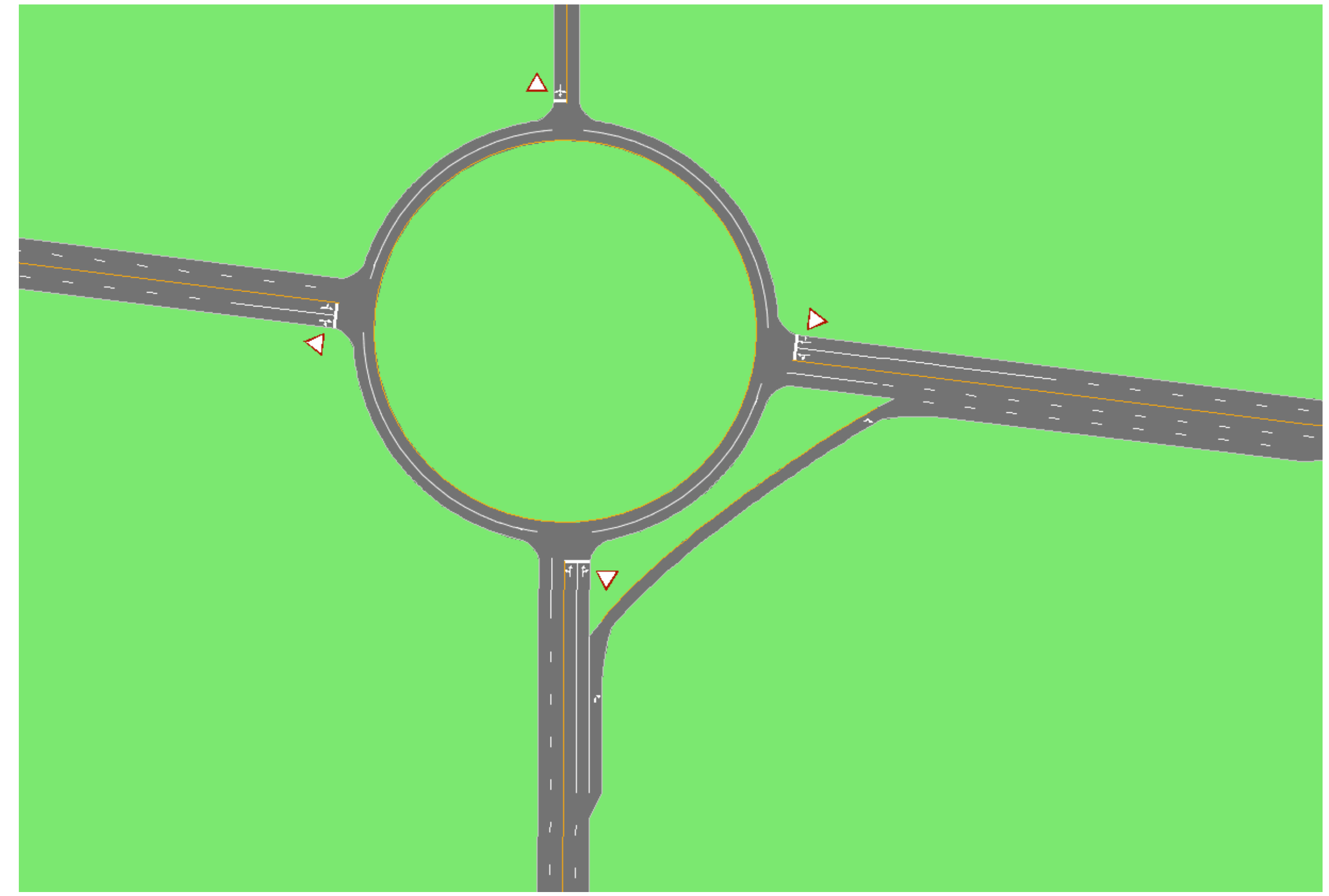
Table 5.15 – SR 80 / James Ranch Road - 2050 Build with Traffic Signal Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	B	C		B	B		C	C	C	D	B		C
Average Delay (s)	16	33		13	12		25	32	29	49	15		30
95th Percentile Queue (ft)	125	375		25	25		25	225	75	225	125		-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS C in the 2050 Build with traffic signal scenario during the PM peak hour. All movements are anticipated to operate at LOS D or better, with 95th percentile queues no greater than 375 feet long.

5.4.3 Roundabout Capacity Analysis Results

An intersection diagram extracted from Synchro showing the roundabout lane geometry used in the 2028 and 2050 Build analyses is presented in **Figure 5.3**.



Note: Synchro diagram shown for visual purposes only. Analysis done using Rodel.

Figure 5.3 – SR 80 / James Ranch Road - Roundabout Diagram

The roundabout geometry was initially analyzed without a NB right-turn bypass lane and was found to provide poor LOS during the 2050 PM peak scenario. Therefore, the roundabout analysis was modified to include a NB right-turn bypass lane, which provides increased capacity.

The results of the 2028 Build AM, 2028 Build PM, 2050 Build AM and 2050 Build PM intersection capacity analyses with the roundabout configuration are shown in **Table 5.16**, **Table 5.17**, **Table 5.18**, and **Table 5.19**, respectively. The Rodel output reports for the roundabout configuration (both with and without the NB right-turn bypass lane) are provided in **Appendix 7**.

Table 5.16 – SR 80 / James Ranch Road - 2028 Build with Roundabout Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	A		A	A			A			A			A
Average Delay (s)	3		2	4			5			8			5
95th Percentile Queue (ft)	25		0	25			25			75			-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS A in the 2028 Build with roundabout scenario during the AM peak hour. All movements are anticipated to operate at LOS A, with 95th percentile queues no greater than 75 feet long.

Table 5.17 – SR 80 / James Ranch Road - 2028 Build with Roundabout Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	A		A	A			A			A			A
Average Delay (s)	3		3	4			5			6			4
95th Percentile Queue (ft)	25		0	25			25			50			-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS A in the 2028 Build with roundabout scenario during the PM peak hour. All movements are anticipated to operate at LOS A, with 95th percentile queues no greater than 50 feet long.

Table 5.18 – SR 80 / James Ranch Road - 2050 Build with Roundabout Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	A		A	A			A			C			B
Average Delay (s)	3		3	7			9			19			12
95th Percentile Queue (ft)	25		0	25			50			450			-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS B in the 2050 Build with roundabout scenario during the AM peak hour. All movements are anticipated to operate at LOS C or better, with 95th percentile queues no greater than 450 feet long.

Table 5.19 – SR 80 / James Ranch Road - 2050 Build with Roundabout Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	A		C	A			A			B			B
Average Delay (s)	5		23	6			7			11			14
95th Percentile Queue (ft)	25		1,025	25			75			125			-

The SR 80 / James Ranch Road intersection is anticipated to operate at an overall LOS B in the 2050 Build with roundabout scenario during the PM peak hour. All movements are anticipated to operate at LOS C or better. The NB right-turn movement has a 95th percentile queue length of 1,025 feet. All other 95th percentile queues are no greater than 125 feet long.

5.5 SR 80 / US 191 Future Build Analysis

The 2028 and 2050 Build LOS, delay, and 95th percentile queues at the SR 80 / US 191 intersection were evaluated using the 2028 and 2050 Build volumes and the existing intersection geometry described previously in Section 3.0 of this report. The Chino Road realignment (which is planned but not funded) was assumed to be complete in the 2028 and 2050 Build analyses; therefore, the south leg of the SR 80 / US 191 intersection was assumed to be open using its currently barricaded geometry except with an extended NB left-turn lane storage length. Signal timing and phasing were optimized at the intersection.

An intersection diagram extracted from Synchro showing the lane geometry is presented in **Figure 5.4**. The results of the 2028 Build AM, 2028 Build PM, 2050 Build AM and 2050 Build PM intersection capacity analyses with the existing traffic signal configuration are shown in **Table 5.20**, **Table 5.21**, **Table 5.22**, and **Table 5.23**, respectively. The Synchro output reports for the SR 80 / US 191 intersection are provided in **Appendix 7**.

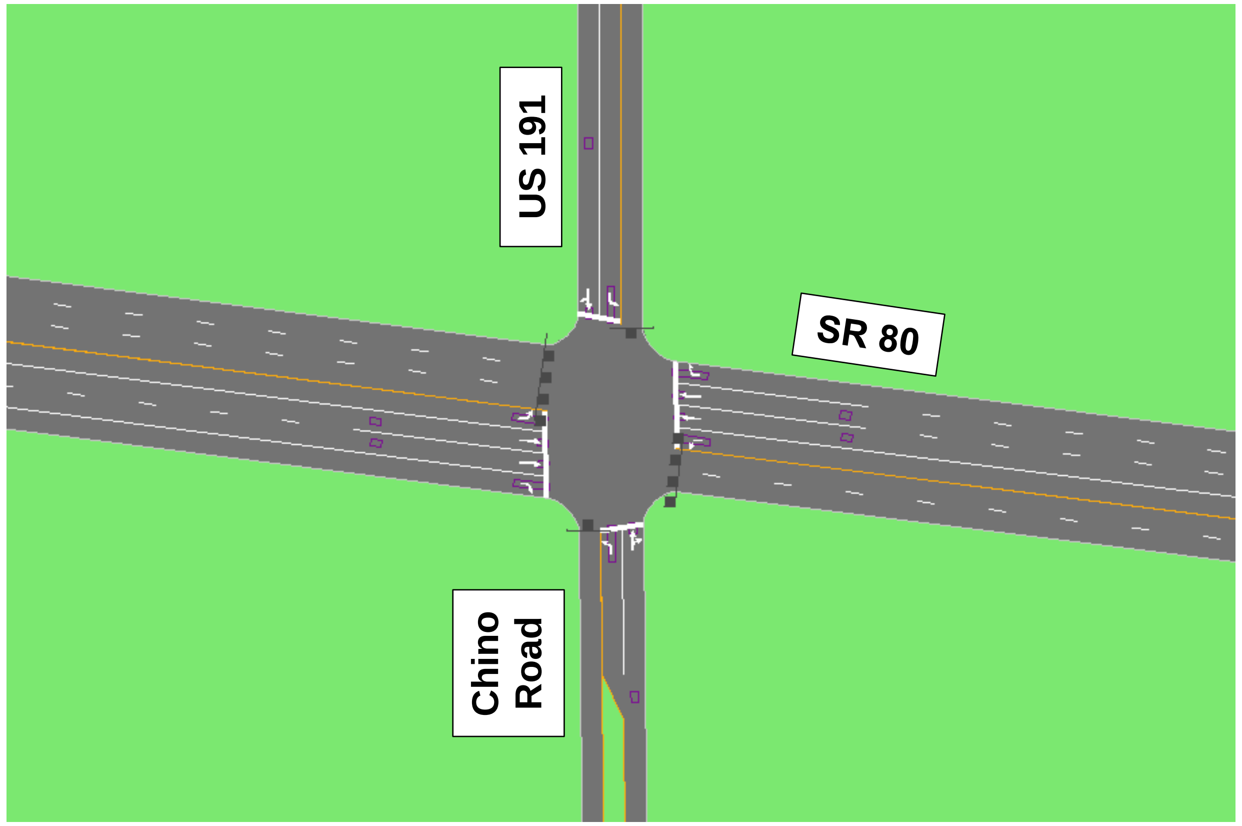


Figure 5.4 – SR 80 / US 191 – Future Intersection Diagram

Table 5.20 – SR 80 / US 191 - 2028 Build Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	B	B		B	B		B	A	A	A	A	A	A
Average Delay (s)	16	13		14	14		10	6	6	6	7	6	9
95th Percentile Queue (ft)	25	25		25	50		25	25	25	0	25	25	-

The SR 80 / US 191 intersection is anticipated to operate at an overall LOS A in the 2028 Build scenario during the AM peak hour with current signal timing and phasing provisions. All movements are anticipated to operate at LOS B or better with 95th percentile queues no greater than 50 feet long.

Table 5.21 – SR 80 / US 191 - 2028 Build Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	C	B		B	B		A	A	A	A	A	A	A
Average Delay (s)	21	16		17	18		10	6	6	7	6	6	9
95th Percentile Queue (ft)	50	25		25	75		50	50	25	25	25	25	-

The SR 80 / US 191 intersection is anticipated to operate at an overall LOS A in the 2028 Build scenario during the PM peak hour. All movements are anticipated to operate at LOS C or better, with 95th percentile queues no greater than 75 feet long.

Table 5.22 – SR 80 / US 191 - 2050 Build Capacity Analysis Results: AM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	D	C		C	D		C	B	B	B	C	B	C
Average Delay (s)	46	24		28	41		25	11	10	13	25	17	24
95th Percentile Queue (ft)	100	50		75	300		100	100	50	25	350	125	-

The SR 80 / US 191 intersection is anticipated to operate at an overall LOS C in the 2050 Build scenario during the AM peak hour, with protected-permitted EB and WB left-turn signal phasing added, which is anticipated to allow all movements to operate at LOS D or better with 95th percentile queues no greater than 350 feet long. All turn lane queues are anticipated to fit within existing storage provisions.

Table 5.23 – SR 80 / US 191 - 2050 Build Capacity Analysis Results: PM Peak Hour

Intersection	NB Approach			SB Approach			EB Approach			WB Approach			Overall
	L	T	R	L	T	R	L	T	R	L	T	R	
LOS	D	C		C	C		C	C	B	B	C	C	C
Average Delay (s)	36	22		24	29		31	21	13	19	25	23	24
95th Percentile Queue (ft)	100	50		50	250		250	325	100	25	200	100	-

The SR 80 / US 191 intersection is anticipated to operate at an overall LOS C in the 2050 Build scenario during the PM peak hour, with protected-permitted EB and WB left-turn signal phasing added, which is anticipated to allow all movements to operate at LOS D or better with 95th percentile queues no greater than 325 feet long. All turn lane queues are anticipated to fit within existing storage provisions.

5.6 Grade Separation Sensitivity Analysis

Grade separation (i.e., a bridge) is not anticipated to be necessary at the SR 80 / James Ranch Road intersection by the horizon year 2050 based on the at-grade intersection analyses. However, a sensitivity analysis was performed to approximate at what point grade separation may need to be considered at the intersection. The signalized intersection LOS was analyzed using HCM 6 methodology via Synchro 11 analysis software, and the roundabout LOS was analyzed using Rodel 2017 methodology. Queue lengths at the signalized intersection were observed using SimTraffic traffic simulation software to be able to observe queue build-ups over time during the peak hours.

Total 2050 volumes were grown incrementally to determine the traffic level at which the at-grade intersection operations fail. Reasonable improvements were assumed for the signalized intersection alternative, including dedicated dual northbound right-turn lanes, northbound right-turn overlap phasing, an extension to the WB left-turn storage length, and signal timing modifications.

The analysis results show that grade separation may be needed if future traffic volumes at the signalized intersection alternative are more than 30 percent higher than the 2050 traffic volumes projected in this report. This equates to approximately 700 to 800 more vehicles entering the intersection during the peak hour. For the roundabout alternative, grade separation may be needed if future traffic volumes are more than 10 to 20 percent higher than the 2050 traffic volumes projected in this report. This equates to approximately 300 to 500 more vehicles entering the roundabout during the peak hour. The Synchro and Rodel output reports for the SR 80 / James Ranch Road intersection with the traffic volume increases are provided in **Appendix 7**.

5.7 Connector Road Cross-Section Analysis

Projected daily traffic volumes on the connector road were analyzed to determine an appropriate roadway cross-section in the horizon year 2050. The connector roadway was analyzed as an urban roadway because many driveways and intersections are anticipated along the roadway to service future development. Exhibit 16-16 of the HCM 6 gives generalized daily service volumes of urban roadway facilities based on number of travel lanes, K-factor, D-factor, and desired LOS. Based on the projected 2050 volumes (up to 19,200 vehicles per day), it is anticipated that a four-lane cross-section (two through lanes in each direction) will provide LOS D or better on the connector road. Exhibit 16-16 of the HCM 6 is included in **Appendix 5**.

6. OTHER TRAFFIC CONSIDERATIONS

Other traffic-related considerations besides traffic operations should be evaluated when determining the advantages and disadvantages of various intersection configuration alternatives at the intersection of SR 80 / James Ranch Road. These include motorist safety, intersection type familiarity, oversize vehicle accommodation, and pedestrian and bicyclist accommodation and safety. Additionally, other traffic-related considerations should be evaluated when determining the design of the connector roadway, including transit accommodation, access, truck parking, and intelligent transportation system (ITS) devices.

6.1 Motorist Safety

One measure of motorist safety for intersection configurations is the number of vehicle conflict points, where vehicles may collide if travel right-of-way rules are not observed. Of particular concern are vehicle crossing points, where vehicles traveling different directions could potentially collide (such as in an angle or left-turn crash). These types of crashes are more likely to cause severe injury to vehicle occupants than vehicles traveling the same general direction (such as sideswipe crashes). Perpendicular crossing points have a high potential for severe injury to vehicle occupants.

A standard four-legged intersection (signalized or TWSC) has 32 conflict points, including 16 crossing points (4 of which are perpendicular). A standard four-legged two-lane roundabout has 24 conflict points, including 8 crossing points (none of which are perpendicular).

Head-on/wrong-way crashes have a high potential for severe injury to vehicle occupants. Head-on/wrong-way travel is prohibited only by signage in the TWSC and signalized intersection alternatives, whereas raised curbs and the angles of intersecting lanes make it more difficult to have head-on/wrong-way travel in the roundabout alternative.

Vehicle speeds in the TWSC and signalized intersection alternatives are controlled only by traffic signals and signage, whereas raised curbs and roadway geometry help reduce vehicle speeds in the roundabout alternative. This reduces the likelihood of severe injury to vehicle occupants in the event of a crash.

The TWSC alternative requires drivers on the minor roadway to judge safe gaps in major roadway traffic to safely turn onto or cross the mainline. Improper judgments may lead to crashes involving crossing conflicts, which tend to be more dangerous (as described previously). The signalized alternative allocates dedicated right-of-way cycle time to each movement, removing the need to judge safe gaps in opposing traffic (barring permissive turning movements). However, failure to properly yield right-of-way at the signalized alternative may still lead to severe crashes as the number of crossing conflict points is the same as the TWSC alternative. The roundabout alternative requires all drivers entering the roundabout to yield to traffic inside the roundabout. While drivers must judge safe gaps in traffic, vehicle speeds within a roundabout tend to be much lower than those on mainline roadways. The reduced speeds combined with the lack of crossing conflict points in a roundabout causes crash at roundabouts to be less severe on average.

6.2 Intersection Type Familiarity

Drivers are likely very familiar with the TWSC and signalized intersection configurations as these traffic control types are very common throughout the U.S. and Mexico. Drivers may be less familiar with how a roundabout operates. While roundabout intersections have become much more prevalent over the last 20 years, they are far less common than TWSC or signalized intersections.

6.3 Oversize Vehicle Accommodation

SR 80 and James Ranch Road are anticipated to be used as routes for oversize vehicles. The SR 80 / James Ranch Road intersection should be designed to accommodate oversize vehicles where feasible. This includes providing adequate vertical clearance and turning radii.

The TWSC intersection alternative can be configured to accommodate oversize vehicles because there are no major horizontal or vertical restrictions. The TWSC intersection alternative can typically be designed to provide adequate turning radii for oversize vehicles.

The signalized intersection alternative can be configured to accommodate oversize vehicles as long as major horizontal and vertical restrictions such as signal poles and mast arms are placed at the correct height and far enough from curbs. The signalized intersection alternative can typically be designed to provide adequate turning radii for oversize vehicles. Because the northbound right-turn movement is anticipated to experience high heavy vehicle traffic volumes, a channelized right-turn bypass lane may be desirable to provide oversize vehicles with a larger turn radius and allow them to bypass the intersection. The bypass lane can be designed as free-flow, yield, or stop-controlled, which eliminates the height restrictions of a traffic signal mast arm.

The roundabout alternative can typically be designed to provide adequate turning radii for oversize vehicles by providing a truck apron and mountable curbs for the central island. However, navigating roundabouts may be difficult for some low-clearance oversize vehicles because of the varying elevation of the intersection from the curbs and islands present. Because the northbound right-turn movement is anticipated to experience high vehicle traffic volumes, a channelized right-turn bypass lane should be considered to provide oversize vehicles with a larger turn radius and allow them to bypass the roundabout.

Vehicle requirements should be coordinated with ADOT’s Statewide Permit Services Supervisor during final design to make sure the proper design vehicle is being used.

6.4 Pedestrian and Bicyclist Accommodation and Safety

The TWSC alternative can provide pedestrian crossings on the north and south legs of the intersection but likely cannot accommodate pedestrians crossing SR 80 (unless some kind of signalized crossing is provided, such as a pedestrian hybrid beacon, or a grade-separated crossing). No pedestrian indications are present, which can make it particularly challenging for those with disabilities to cross.

The signalized alternative can provide pedestrian crossings and crossing indications on all legs of the intersection. Crossing indications can be both visual and audible.

Because the roundabout alternative is yield-controlled, there are typically no signalized crossings for pedestrians, which can make it challenging for those with disabilities to cross. This may be offset to some degree, however, by the lower speed of vehicles at the crossings, as lower vehicle speeds reduce the likelihood of severe injury to pedestrians. Pedestrian-actuated signals or pedestrian hybrid beacons could be added to address this issue but doing so will impede traffic movements entering and exiting the roundabout when the signals/beacons are activated. Grade-separated pedestrian crossings could also be considered.

The TWSC and signalized alternatives typically provide separate facilities for pedestrians (sidewalk) and bicyclists (bike lanes or paved shoulders) on and along each approach. Roundabouts do not typically include bike lanes within the circulating area due to safety concerns. The roundabout alternative could include ramps for bicyclists to transition between the bike lane or paved shoulder and the sidewalk at the intersection.

The design of the connector road should also consider accommodations for pedestrians and bicyclists such as sidewalks and bike lanes due to the anticipated warehousing land uses and other developments along and near the roadway.

6.5 Transit Accommodation

Future bus stops should be considered along or near the connector road to accommodate commuter traffic generated by the anticipated warehousing land uses and other developments along and near the roadway.

6.6 Access

Future access points along the connector road should including adequate access spacing and turning radii should be designed to accommodate heavy vehicles.

6.7 Truck Parking

Truck parking needs should be considered when designing the connector road due to the anticipated high truck volumes utilizing the roadway and the fact that trucks may have to wait to cross the border if it is not open yet.

6.8 ITS Devices

ADOT has indicated there is the potential for the ADOT Commercial Inspection Facility to be relocated from the northeast corner of the intersection of SR 80 / US 191 to a location along the connector roadway north of the proposed commercial IPOE. The need for ITS devices should be considered when deciding whether/where to relocate the facility. If the ADOT Commercial Inspection Facility stays in its current location, additional cameras, weigh-in-motion sensors, and dynamic message signs may need to be placed east and west of the intersection of SR 80 / James Ranch Road to alert ADOT to heavy vehicles that do not go to the ADOT Commercial Inspection Facility for inspection (i.e., “port runners”). If the ADOT Commercial Inspection Facility is relocated along the connector road, fewer ITS devices may be needed because trucks will have to pass through the inspection station before continuing along their route. ITS devices along SR 80 may still be desirable to detect “port runners” and overweight vehicles.

7. ENVIRONMENTAL REPORT DATA SUMMARY

ADOT requires a Noise Report and Air Quality Report as part of the Environmental Planning process, which include documentation of vehicle classifications, traffic projections and intersection/interchange LOS analysis for the Existing, 2028/2050 No-Build, and 2028/2050 Build scenarios. The following section summarizes these results for use in the Noise Report and Air Quality Report.

7.1 Noise Report Data Summary

For the purposes of this analysis, vehicle volumes were divided into the following three vehicle classification categories:

- Passenger cars;
- Medium vehicles; and
- Heavy vehicles.

Traffic volumes were categorically classified using the FHWA 13-Class classification scheme, where passenger cars are in FHWA Classes 1-4, medium vehicles are in FHWA Class 5, and heavy vehicles are in FHWA Classes 6-13. **Table 7.1**, **Table 7.2**, **Table 7.3**, and **Table 7.4** summarize the approximate weighted average percentages of passenger cars, medium vehicles, and heavy vehicles by total traffic volume on each leg of the study area intersections in the No-Build and Build scenarios, respectively.

All vehicles coming to and from the proposed commercial IPOE and all truck volumes on the north leg of SR 80 / James Ranch Road and the south leg of SR 80 / US 191 (Chino Road) were assumed to be heavy vehicles to provide a conservative analysis as detailed truck classification data were not available for these approaches. Additionally, truck trips generated by the adjacent warehousing developments were assumed to be comprised of 30 percent medium vehicles and 70 percent heavy vehicles to provide a conservative analysis.

Table 7.1 – 2028 / 2050 No-Build Noise Report Vehicle Classification Percentages

Roadway Segment	Passenger Cars	Medium Vehicles	Heavy Vehicles
James Ranch Road south of SR 80	98%	0%	2%
James Ranch Road north of SR 80	98%	0%	2%
SR 80 west of James Ranch Road	89%	6%	5%
SR 80 east of James Ranch Road	89%	6%	5%
US 191 south of SR 80	-	-	-
US 191 north of SR 80	89%	7%	4%
SR 80 west of US 191	89%	7%	4%
SR 80 east of US 191	89%	7%	4%

Table 7.2 – 2050 No-Build Noise Report Vehicle Classification Percentages

Roadway Segment	Passenger Cars	Medium Vehicles	Heavy Vehicles
James Ranch Road south of SR 80	98%	0%	2%
James Ranch Road north of SR 80	98%	0%	2%
SR 80 west of James Ranch Road	89%	6%	5%
SR 80 east of James Ranch Road	89%	6%	5%
US 191 south of SR 80	-	-	-
US 191 north of SR 80	89%	7%	4%
SR 80 west of US 191	89%	7%	4%
SR 80 east of US 191	89%	7%	4%

Table 7.3 – 2028 Build Noise Report Vehicle Classification Percentages

Roadway Segment	Passenger Cars	Medium Vehicles	Heavy Vehicles
James Ranch Road south of SR 80	70%	5%	25%
James Ranch Road north of SR 80	98%	0%	2%
SR 80 west of James Ranch Road	82%	6%	12%
SR 80 east of James Ranch Road	79%	5%	15%
Chino Road south of SR 80	95%	0%	5%
US 191 north of SR 80	73%	6%	21%
SR 80 west of US 191	77%	6%	17%
SR 80 east of US 191	85%	8%	7%

Table 7.4 – 2050 Build Noise Report Vehicle Classification Percentages

Roadway Segment	Passenger Cars	Medium Vehicles	Heavy Vehicles
James Ranch Road south of SR 80	76%	6%	19%
James Ranch Road north of SR 80	98%	0%	2%
SR 80 west of James Ranch Road	83%	6%	11%
SR 80 east of James Ranch Road	80%	6%	14%
Chino Road south of SR 80	95%	0%	5%
US 191 north of SR 80	76%	6%	18%
SR 80 west of US 191	79%	6%	15%
SR 80 east of US 191	83%	8%	9%

Table 7.5 and **Table 7.6** summarize the bidirectional ADT volumes and peak hour volumes on each leg of the intersections of SR 80 / James Ranch Road and SR 80 / US 191, respectively. The bidirectional peak hour volumes were calculated using the peak hour volumes shown in **Figure 3.3** through **Figure 3.10** and the vehicle classification percentages shown in the previously referenced **Table 2.1**, **Table 7.1**, and **Table 7.2**.

Table 7.5 – SR 80 / James Ranch Road Noise Report Traffic Volumes

	Roadway Segment	ADT Volume (vpd)	Peak Hour Volume (vph)			
			Total	Passenger Cars	Medium Vehicles	Heavy Vehicles
Existing	James Ranch Road south of SR 80	0	0	0	0	0
	James Ranch Road north of SR 80	0	0	0	0	0
	SR 80 west of James Ranch Road	5,667	475	423	29	24
	SR 80 east of James Ranch Road	5,667	475	423	29	24
2028 No-Build	James Ranch Road south of SR 80	300	30	29	0	1
	James Ranch Road north of SR 80	300	30	29	0	1
	SR 80 west of James Ranch Road	6,700	550	493	31	27
	SR 80 east of James Ranch Road	6,700	550	492	32	27
2050 No-Build	James Ranch Road south of SR 80	700	60	59	0	1
	James Ranch Road north of SR 80	700	60	59	0	1
	SR 80 west of James Ranch Road	10,500	860	771	48	41
	SR 80 east of James Ranch Road	10,500	860	769	49	42
2028 Build	James Ranch Road south of SR 80	6,300	563	395	29	140
	James Ranch Road north of SR 80	300	30	29	0	1
	SR 80 west of James Ranch Road	8,000	643	530	35	78
	SR 80 east of James Ranch Road	13,200	1021	811	56	154
2050 Build	James Ranch Road south of SR 80	19,200	1,728	1,312	97	320
	James Ranch Road north of SR 80	700	60	59	0	1
	SR 80 west of James Ranch Road	14,100	1,122	932	63	127
	SR 80 east of James Ranch Road	30,500	2305	1,852	131	322

Table 7.6 – SR 80 / US 191 Noise Report Traffic Volumes

	Roadway Segment	ADT Volume (vpd)	Peak Hour Volume (vph)			
			Total	Passenger Cars	Medium Vehicles	Heavy Vehicles
Existing	Chino Rd south of SR 80	0	0	0	0	0
	US 191 north of SR 80	3,681	317	282	19	16
	SR 80 west of US 191	5,667	476	423	29	24
	SR 80 east of US 191	8,941	538	479	48	11
2028 No-Build	Chino Rd south of SR 80	0	0	0	0	0
	US 191 north of SR 80	5,000	357	318	25	14
	SR 80 west of US 191	6,400	536	477	37	21
	SR 80 east of US 191	9,400	606	540	42	24
2050 No-Build	Chino Rd south of SR 80	0	0	0	0	0
	US 191 north of SR 80	7,700	552	491	39	22
	SR 80 west of US 191	10,000	828	737	58	33
	SR 80 east of US 191	14,500	937	834	66	37
2028 Build	Chino Rd south of SR 80	3,500	297	282	0	14
	US 191 north of SR 80	6,900	485	356	28	102
	SR 80 west of US 191	12,600	998	772	59	166
	SR 80 east of US 191	11,900	711	601	57	52
2050 Build	Chino Rd south of SR 80	5,400	459	437	0	22
	US 191 north of SR 80	11,900	843	642	50	152
	SR 80 west of US 191	29,500	2,270	1,794	137	339
	SR 80 east of US 191	28,000	1,721	1,434	129	158

7.2 Air Quality Report Data Summary

Table 7.7 and **Table 7.8** summarize the ADTs for all vehicles, ADTs for trucks (includes the combination of medium and heavy vehicles), and truck percentages (both medium and heavy vehicles) on each leg of the intersections of SR 80 / James Ranch Road and SR 80 / US 191, respectively.

Table 7.7 – SR 80 / James Ranch Road Air Quality Report Daily Traffic Volumes and Truck Percentages

	Existing	2028 No-Build	2028 Build	Difference (2028 Build vs. No-Build)	2050 No-Build	2050 Build	Difference (2050 Build vs. No-Build)
James Ranch Road south of SR 80							
Total ADT	0	300	6,300	6,000	700	19,200	18,500
Truck ADT	0	1	168	168	1	417	415
Truck %	0%	2%	30%	28%	2%	24%	22%
James Ranch Road north of SR 80							
Total ADT	0	300	300	0	700	700	0
Truck ADT	0	1	1	0	1	1	0
Truck %	0%	2%	2%	0%	2%	2%	0%
SR 80 west of James Ranch Road							
Total ADT	5,667	6,700	8,000	1,300	10,500	14,100	3,600
Truck ADT	52	58	113	55	89	189	100
Truck %	11%	11%	18%	7%	10%	17%	6%
SR 80 east of James Ranch Road							
Total ADT	5,667	6,700	13,200	6,500	10,500	30,500	20,000
Truck ADT	52	59	210	151	91	453	362
Truck %	11%	11%	21%	10%	11%	20%	9%

Table 7.8 – SR 80 / US 191 Air Quality Report Daily Traffic Volumes and Truck Percentages

	Existing	2028 No-Build	2028 Build	Difference (2028 Build vs. No-Build)	2050 No-Build	2050 Build	Difference (2050 Build vs. No-Build)
Chino Rd south of SR 80							
Total ADT	0	0	3,500	3,500	0	5,400	5,400
Truck ADT	0	0	14	14	0	22	22
Truck %	0%	0%	5%	5%	0%	5%	5%
US 191 north of SR 80							
Total ADT	3,681	5,000	6,900	1,900	7,700	11,900	4,200
Truck ADT	35	39	129	90	61	201	141
Truck %	11%	11%	27%	16%	11%	24%	13%
SR 80 west of US 191							
Total ADT	5,667	6,400	12,600	6,200	10,000	29,500	19,500
Truck ADT	52	59	226	167	91	476	385
Truck %	11%	11%	23%	12%	11%	21%	10%
SR 80 east of US 191							
Total ADT	8,941	9,400	11,900	2,500	14,500	28,000	13,500
Truck ADT	59	67	109	43	103	287	184
Truck %	11%	11%	15%	4%	11%	17%	6%

Table 7.9 summarizes the overall intersection LOS for scenarios with signalized and roundabout intersections or the worst movement LOS for TWSC scenarios at each study intersection during the AM and PM peak hours.

Table 7.9 – Air Quality Report Overall Intersection Level of Service by Scenario

Intersection	Scenario	LOS	
		AM	PM
SR 80 / James Ranch Road	Existing TWSC^	B	B
	2028 No-Build TWSC^	B	B
	2050 No-Build TWSC^	C	C
	2028 Build TWSC^	E	D
	2050 Build TWSC^	F	F
	2028 Build Signalized	A	B
	2050 Build Signalized	C	C
	2028 Build Roundabout	A	A
	2050 Build Roundabout	B	B
SR 80 / US 191/ Chino Road	Existing	A	A
	2028 No-Build	A	A
	2050 No-Build	A	A
	2028 Build	A	A
	2050 Build	C	C

^TWSC values represent worst movement LOS instead of overall intersection LOS.

8. SUMMARY

The principal findings of the traffic analysis are summarized below:

SR 80 / James Ranch Road

- The existing TWSC intersection provides LOS B in Existing and 2028 No-Build traffic conditions and LOS C or better in 2050 No-Build traffic conditions on the NB and SB approaches with current intersection geometry.
- The TWSC intersection alternative provides LOS E or better in 2028 Build traffic conditions and LOS F in 2050 Build traffic conditions on the NB and SB approaches, even with an exclusive NB right-turn lane provided.
- The signalized intersection alternative provides overall LOS C or better in 2028 and 2050 Build traffic conditions as long as an exclusive NB right-turn lane with an overlap right-turn signal phase and dual westbound left-turn lanes are provided.
- The roundabout intersection alternative provides overall LOS B or better in 2028 and 2050 Build traffic conditions as long as an exclusive free-flow NB right-turn bypass lane is provided.

SR 80 / US 191

- The existing signalized intersection provides overall LOS A in Existing and 2028 No-Build traffic conditions, and overall LOS B in 2050 No-Build traffic conditions, with current intersection geometry and optimized traffic signal timing.
- The existing signalized intersection provides overall LOS A in 2028 Build traffic conditions and LOS C in 2050 Build traffic conditions with current intersection geometry and the opening of the south leg for the realigned Chino Road as long as protected-permitted left-turn EB and WB signal phasing is provided by 2050.

Table 8.1 summarizes the overall intersection LOS for scenarios with signalized and roundabout intersections or the worst movement LOS for TWSC scenarios at each study intersection during the AM and PM peak hours.

Table 8.1 – Overall Level of Service/Longest Queue by Scenario

Intersection	Scenario	LOS / Queue	
		AM	PM
SR 80 / James Ranch Road	Existing TWSC^	B / 0’	B / 0’
	2028 No-Build TWSC^	B / 25’	B / 25’
	2050 No-Build TWSC^	C / 50’	C / 50’
	2028 Build TWSC^	E / 25’	D / 75’
	2050 Build TWSC^	F / *	F / *
	2028 Build Signalized	A / 25’	B / 25’
	2050 Build Signalized	C / 325’	C / 375’
	2028 Build Roundabout	A / 75’	A / 50’
	2050 Build Roundabout	B / 450’	B / 1,025’
SR 80 / US 191/ Chino Road	Existing	A / 25’	A / 25’
	2028 No-Build	A / 25’	A / 25’
	2050 No-Build	A / 50’	A / 50’
	2028 Build	A / 50’	A / 75’
	2050 Build	C / 350’	C / 325’

* Value not reported due to HCM limitations. Significant delays/queueing anticipated.
^TWSC values represent worst movement LOS instead of overall intersection LOS.

Comparison of SR 80 / James Ranch Road Intersection Configuration Alternatives

The various SR 80 / James Ranch Road intersection configuration alternatives (TWSC, Traffic Signal Control, and Roundabout) were compared to each other using several different evaluation criteria. Some of the evaluation criteria used do not lend themselves to numerical quantification, so the evaluation was performed on a “qualitative” basis using the following descriptors to describe the relative impacts of each of the alternatives:

- Strong Advantage;
- Advantage;
- Neutral;
- Disadvantage; and
- Strong Disadvantage.

The Strong Advantage and Advantage descriptors apply when implementation of an alternative is anticipated to result in a positive change or improvement compared to the other alternatives. The Strong Disadvantage and Disadvantage descriptors apply when implementation of an alternative is anticipated to result in a negative change or worsening compared to the other alternatives. The Neutral descriptor applies when implementation of an alternative is anticipated to have no impact or result in both positive and negative changes that effectively cancel each other out.

Table 8.2 summarizes the relative advantages and disadvantages of the alternatives.

Table 8.2 – Intersection Configuration Alternatives Evaluation Matrix of Traffic Criteria

Evaluation Criteria	No-Build (TWSC)	Two-Way Stop Control (TWSC)	Traffic Signal Control	Roundabout
Traffic Operations (2050 AM/PM)	◐ - LOS C/C - Maximum queues of 50/50 feet	● - LOS F/F - Significant queueing expected	◐ - LOS C/C - Maximum queues of 325/375 feet	◐ - LOS B/B - Maximum queues of 450/1,025 feet
Motorist Safety	● - 32 conflict points, 16 crossing points (4 perpendicular) - Speed and wrong-way control by signs only	● - 32 conflict points, 16 crossing points (4 perpendicular) - Speed and wrong-way control by signs only	◑ - 32 conflict points, 16 crossing points (4 perpendicular) - Speed and wrong-way control by signals and signs	◐ - 24 conflict points, 8 crossing points (0 perpendicular) - Speed and wrong-way control by curbs and roadway geometry
Driver Familiarity	🔵 - Very common configuration	🔵 - Very common configuration	🔵 - Very common configuration	◐ - Somewhat common configuration
Oversize Vehicle Accommodation	🔵 - Open geometry with no major horizontal or vertical restrictions	🔵 - Open geometry with no major horizontal or vertical restrictions	◐ - Open geometry; vertical restrictions due to signal mast arms	◑ - Restricted geometry; option for large-radius bypass lanes
Pedestrian and Bicyclist Accommodation and Safety	● - No pedestrian accommodations - Paved shoulders for cyclists - High vehicle speeds negatively affect pedestrian and bicyclist safety and comfort	◑ - At-grade crossings can be provided on stop-controlled legs - Signalized or grade-separated crossing required to cross SR 80 - Includes standard pedestrian and bicyclist facilities - High vehicle speeds negatively affect pedestrian and bicyclist safety and comfort	○ - At-grade crossings can be provided on all 4 legs; all signalized - Includes standard pedestrian and bicyclist facilities - High vehicle speeds negatively affect pedestrian and bicyclist safety and comfort	◐ - At-grade crossings can be provided on all 4 legs - Includes standard pedestrian and bicyclist facilities - Moderate vehicle speeds somewhat affect pedestrian and bicyclist safety and comfort - Cyclists must transition from roadway to sidewalk

Legend

Strong Advantage 🔵 Advantage ◐ Neutral ○ Disadvantage ◑ Strong Disadvantage ●

Findings from Alternatives Evaluation of Traffic Considerations

- If the proposed commercial IPOE and connector road are not built, the existing TWSC configuration is expected to provide acceptable traffic operations through 2050 at SR 80 / James Ranch Road.
- The TWSC alternative likely will not provide acceptable traffic operations where the connector road for the proposed commercial IPOE intersects with SR 80.
- The roundabout alternative provides the most benefit at the SR 80 / James Ranch Road intersection in terms of safety and LOS but will likely have a much longer queue than the signalized alternative.
- Drivers are most familiar with the TWSC and signalized alternatives and may be less familiar with the roundabout alternative.
- Oversize vehicles can most easily be accommodated by the TWSC alternative, followed by the signalized alternative; the roundabout alternative can be challenging for oversize vehicles to navigate if not designed specifically to accommodate oversize vehicles.
- Other factors besides traffic considerations (e.g., right-of-way impacts, cost, etc.) should be considered before determining the preferred intersection configuration at SR 80 / James Ranch Road.

Traffic-Related Considerations for the Connector Road

- Future bus stops should be considered along or near the connector road to accommodate commuter traffic generated by the anticipated warehousing land uses and other developments along and near the roadway.
- Future access points along the connector road should including adequate access spacing and turning radii should be designed to accommodate heavy vehicles.
- Truck parking needs should be considered when designing the connector road due to the anticipated high truck volumes utilizing the roadway and the fact that trucks may have to wait to cross the border if it is not open yet.
- If the ADOT Commercial Inspection Facility stays in its current location, ITS devices such as additional cameras, weigh-in-motion sensors, and dynamic message signs may need to be placed east and west of the intersection of SR 80 / James Ranch Road to alert ADOT to heavy vehicles that do not go to the ADOT Commercial Inspection Facility for inspection (i.e., “port runners”). If the ADOT Commercial Inspection Facility is relocated along the connector road, fewer ITS devices may be needed because trucks will have to pass through the inspection station before continuing along their route. ITS devices along SR 80 may still be desirable to detect “port runners” and overweight vehicles.

Appendix 1. Stantec 2018 *Douglas Arizona Regional Feasibility Study* Excerpts

Douglas Arizona Regional Feasibility Study

Traffic Study for the Raul Hector Castro Land Port of Entry in Douglas, Arizona

June 29, 2018

Prepared for:

General Services Administration

Prepared by:

Stantec Consulting

1.0 DETERMINING BASELINE FUNCTIONS

1.1 VEHICLE VOLUMES

Stantec was provided traffic data by the U.S. Customs and Border Protection (CBP). This data included time-stamped volumes passing through the facility for a 12-month period (February 2017 to January 2018). The 90th percentile weekly volume was recommended for determining volumes to use in the baseline Scenario.

The study team determined that the volumes of both Personally Owned Vehicles (POVs) and Commercially Operated Vehicles (COVs) are the driving factors that affect traffic flow, queues, and wait time. The number of POVs and COVs were therefore combined to determine the peak week.

The 90th percentile peak week for both personal and commercial vehicles was found to be from October 18th to October 24th, 2017, with a total of 37,551 vehicles (POVs and COVs) passing through the facility during this week (see **Figure A**). This 90th percentile volume, which was identified as the 47th highest volume by week, was found using the following method:

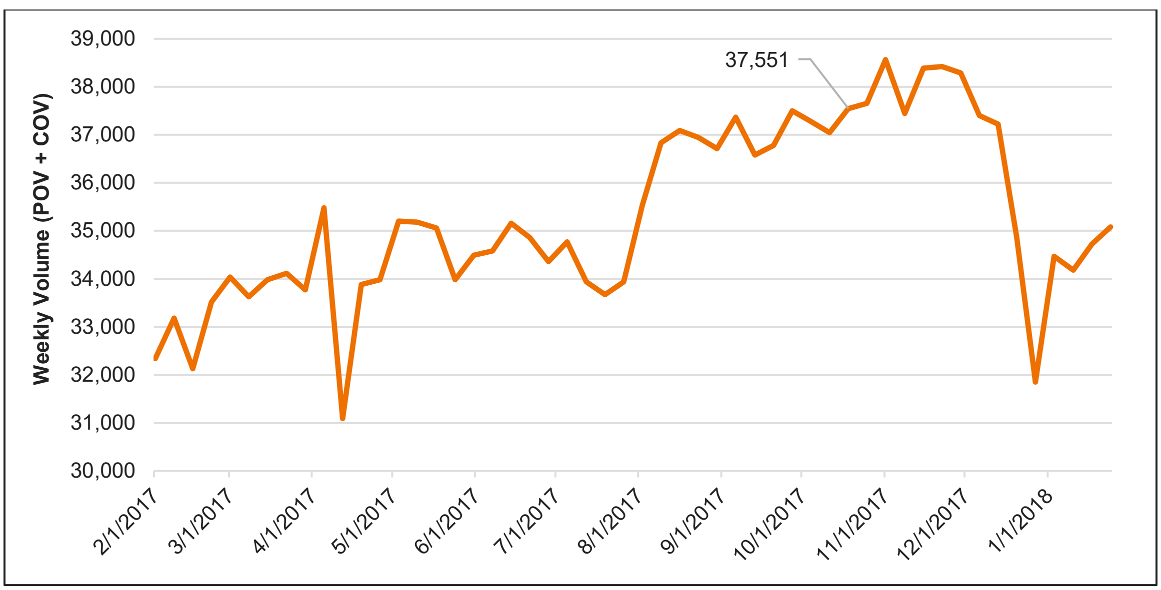
To find the 90th percentile weekly volume:

n = number of weeks = 52

p = percentile = 0.90

n x *p* = 52 x 0.90 = 46.8 – or the **47th highest volume week**

Figure A: Weekly Combined POV and COV Volumes (February 2017 to January 2018)



Furthermore, it was determined that the highest-volume day of that peak week was Thursday, October 19, 2017, with a total of 5,504 POVs and 129 COVs entering the facility (see **Table 1.1**).

Table 1.1: Daily POV and COV Volumes during the 90th Percentile Peak Week

Date	# POVs	# COVs	Combined Total
Wednesday, October 18, 2017	5,307	106	5,413
Thursday, October 19, 2017	5,504	129	5,633
Friday, October 20, 2017	5,376	117	5,493
Saturday, October 21, 2017	4,957	24	4,981
Sunday, October 22, 2017	5,119	-	5,119
Monday, October 23, 2017	5,305	118	5,423
Tuesday, October 24, 2017	5,381	108	5,489

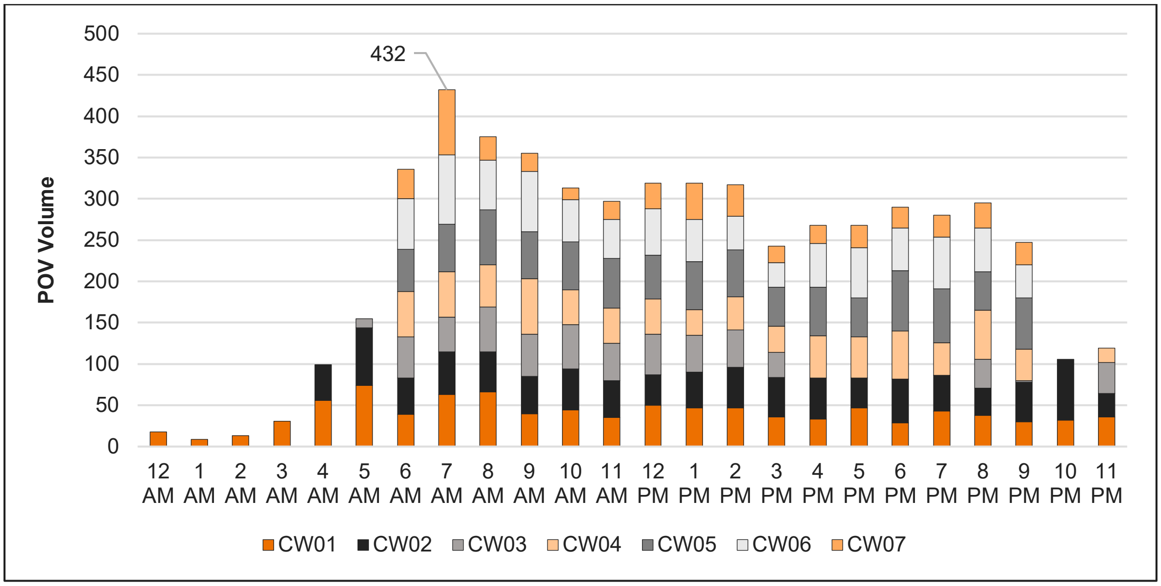
1.1.1 Peak Period

In analyzing the time-stamped processing times for October 19, 2017, the volume of vehicles that pass through each of the seven POV booths can be determined. The booths are referred to as CW01 on the far-right to CW07 at far-left. One can see from **Figure B** that typically all seven booths are open during the peak period. The far-left booth (CW07) is allocated for SENTRI vehicles.

Figure B: Aerial Image Looking Northbound from Mexico at the Douglas LPOE
(Date and Time Unknown)

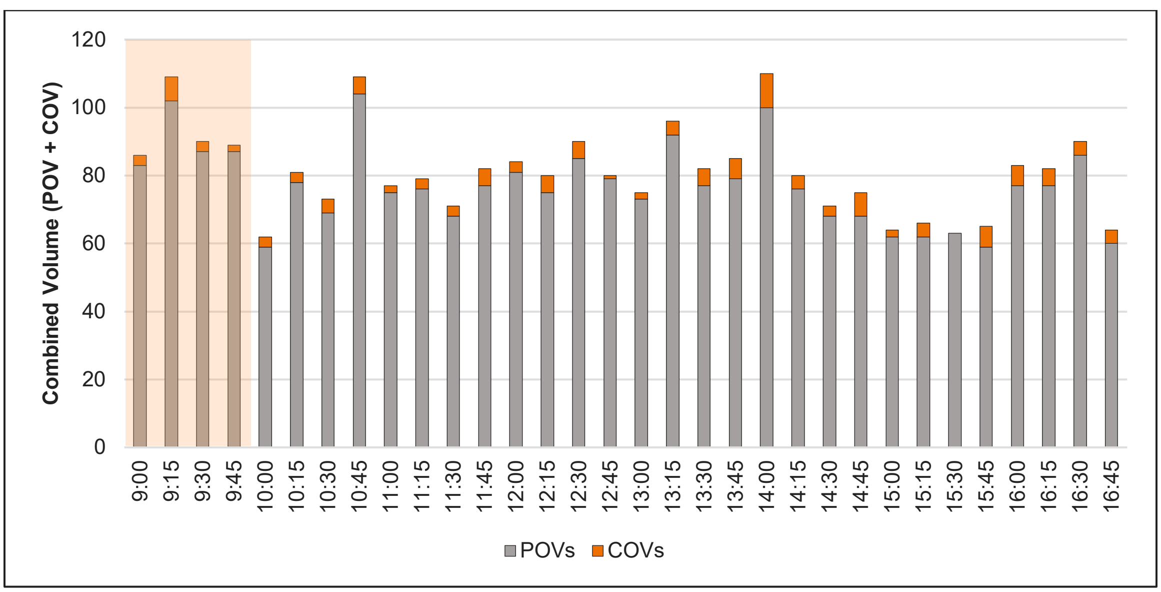
It can be determined from the data that the peak period for POVs is from 7am to 8am, with 432 vehicles processed during that hour on October 19, 2017 (see **Figure C**). This peak hour also represents the highest volume of SENTRI vehicles that pass through booth CW07.

Figure C: Hourly POV Volumes by Booth on October 19, 2017



However, in an effort to capture the peak time window for both POVs and COVs, it is necessary to focus on the hours between 9am and 5pm, when the COV processing facility is open. The volumes processed during those eight hours were isolated for analysis. **Figure D**, below, displays the 15-minute volumes counted between 9am and 5pm for POVs and COVs combined. When the 15-minute volumes are summed for each hour, the combined peak hour is identified as 9am to 10am, with 374 total vehicles entering the facility during this hour (359 POVs and 15 COVs).

Figure D: 15-minute Volumes for 9am to 5pm on October 19, 2017

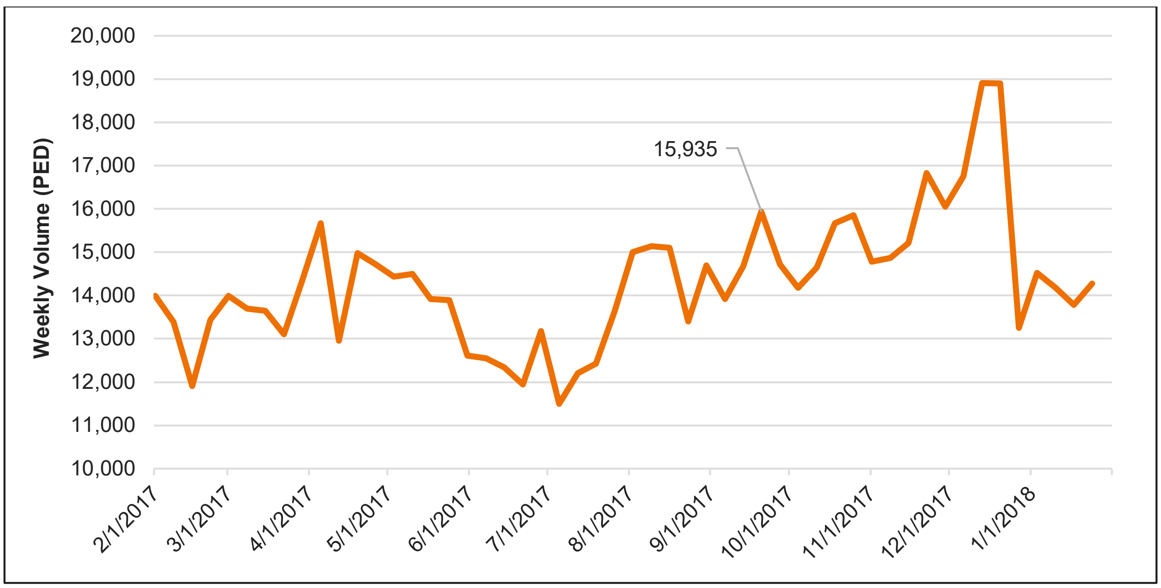


1.2 PEDESTRIAN VOLUMES

Pedestrian (PED) volumes were analyzed separately since they have their own processing facility and booths that are detached from the vehicle processing area. Currently, once processed, pedestrians that wish to access the building facility are required to cross the street where POVs drive through either to exit the facility or to park for secondary inspection. It is recommended that any new facility design allows for minimal interaction between pedestrians and vehicles to avoid conflicts.

Figure E shows the weekly PED volumes that entered the facility from February 2017 to January 2018. Although one can see a significant peak during the month of December, the 90th percentile peak week for pedestrians was found to be from September 20th to September 26th, 2017, with a total of 15,935 pedestrians entering the facility during that week. This 90th percentile volume was identified using the same methodology discussed in **Section 1.1**.

Figure E: Weekly PED Volumes (February 2017 to January 2018)



Furthermore, it was determined that the highest day of that peak week was Friday, September 22, 2017, with a total of 2,467 PEDs entering the facility (see **Table 1.4**).

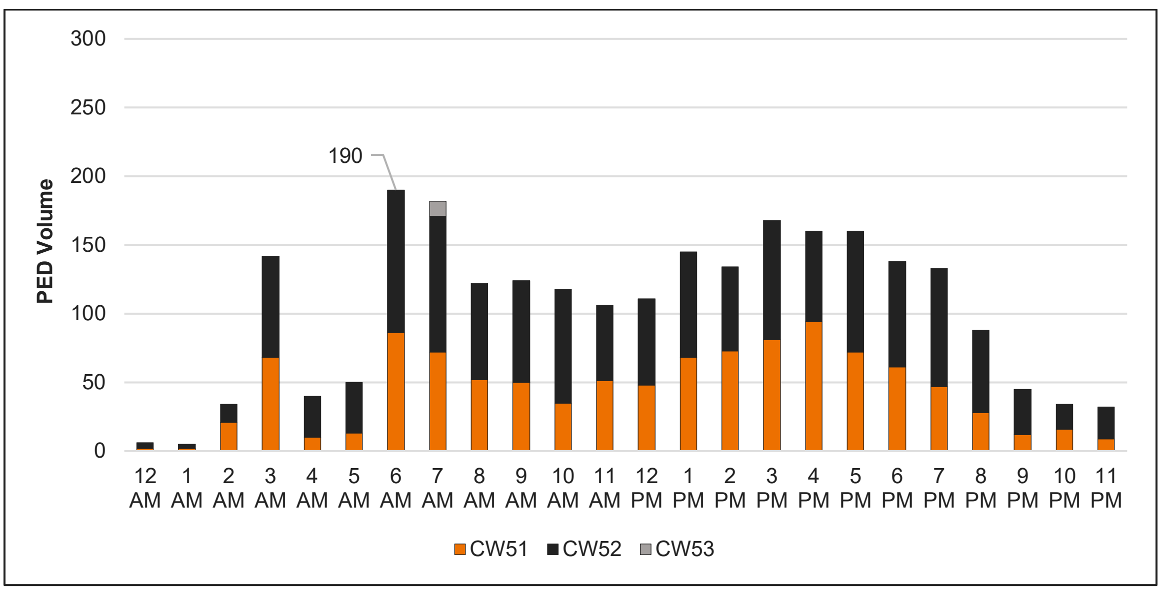
Table 1.4: Daily PED Volumes during the 90th Percentile Peak Week

Date	# PEDs	Weekly Total
Wednesday, September 20, 2017	2,159	15,935
Thursday, September 21, 2017	2,422	
Friday, September 22, 2017	2,467	
Saturday, September 23, 2017	2,457	
Sunday, September 24, 2017	1,917	
Monday, September 25, 2017	2,347	
Tuesday, September 26, 2017	2,166	

1.2.1 Peak Period

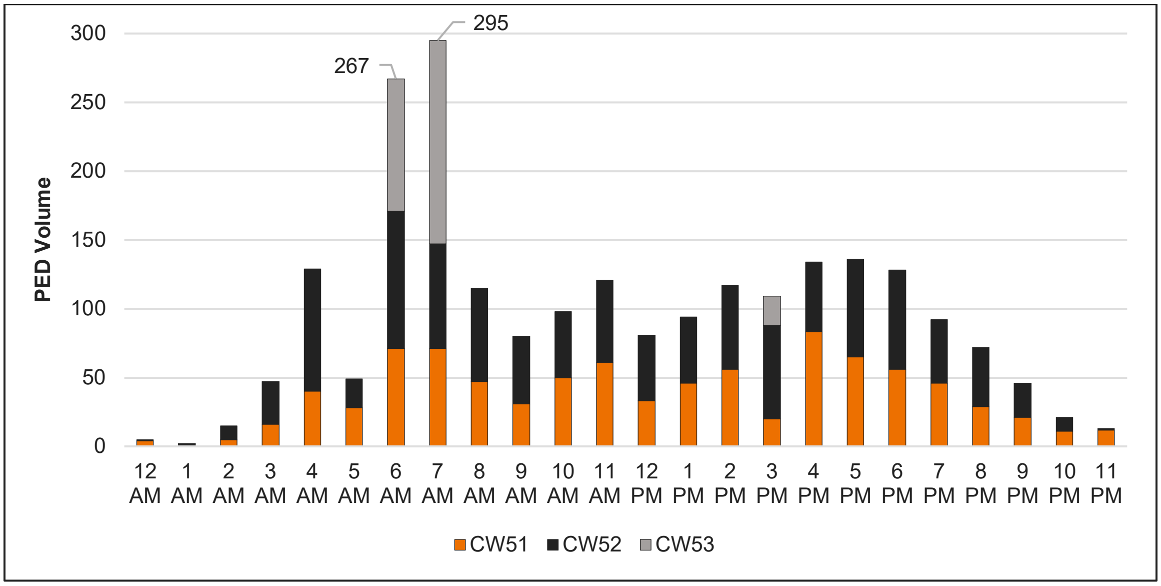
A closer look at the pedestrian crossing data for September 22, 2017 shows a peak from 6am to 7am, with 190 PEDs entering the facility (see **Figure F**). There are three processing booths for pedestrians. However, booth CW53 was in operation for only seven minutes on September 22nd, and processed 11 pedestrians from 7:39am to 7:46am.

Figure F: Hourly PED Volumes by Booth on September 22, 2017



It is clear from the data for September 22, 2017 that not all three booths are in operation simultaneously all the time. In comparison, on October 19, 2017, which was the day chosen to model baseline behavior for vehicles, all three booths were in operation for a longer period of time. On that day, all three booths operated from 6am to 8am, and again from 3pm to 4pm (see **Figure G**). The total volume of PEDs entering the facility that day was 2,266, with volumes of 267 from 6am to 7am and 295 from 7am to 8am. This higher-volume period was utilized going forward to provide a more conservative view of the operations of the pedestrian processing facility.

Figure G: Hourly PED Volumes by Booth on October 19, 2017



1.2.2 Pedestrian Processing Times

Just like vehicles, pedestrians entering the facility are also required to pass through a booth for admittance into the USA. **Table 1.5**, below, shows the processing times by booth from 6am to 8am on October 19, 2017. The average PED processing time was determined to be 29 seconds.

Table 1.5: PED Processing Times by Booth for 6am to 8am on October 19, 2017

Time (min:sec)	CW51	CW52	CW53	Average (CW51 – CW53)
Min Time	00:05	00:04	00:04	00:04
50th Percentile	00:33	00:27	00:10	00:23
90th Percentile	01:37	01:35	00:34	01:15
Max Time	06:02	03:58	06:34	05:31

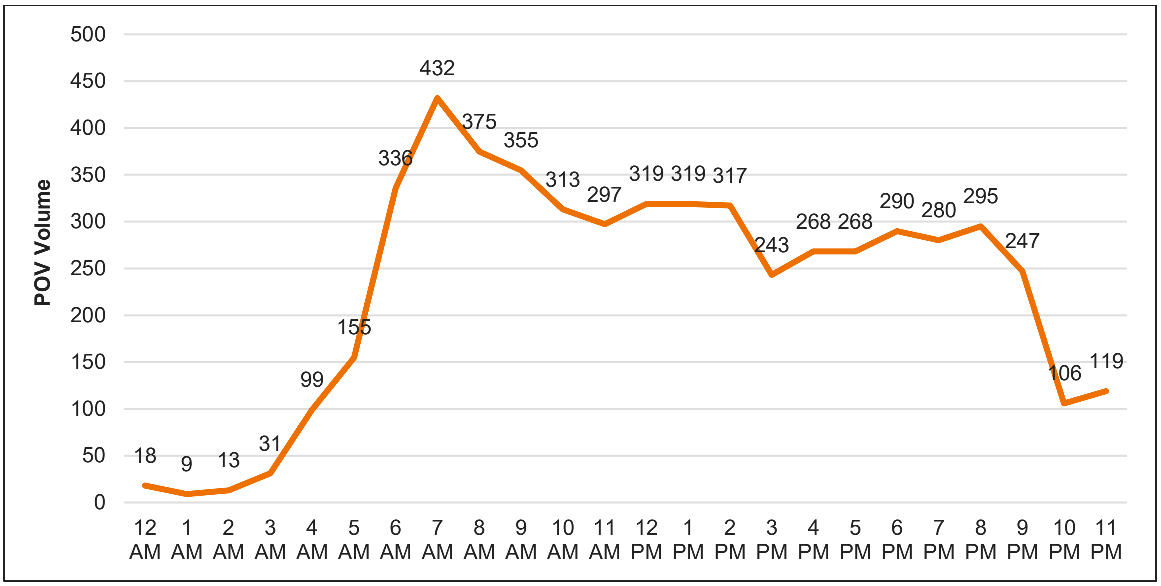
1.2.3 Pedestrian Admittance

The data from CBP also provides insight into the percentage of pedestrians admitted into the USA versus not admitted. An average of 97.38% of PEDs entering the facility pass through into the USA, while 2.62% of PEDs are not admitted.

2.0 DETERMINING DEMAND

To better understand the daily demand for POVs that enter the Douglas LPOE facility, the total number of POVs that passed through on the baseline scenario peak day of October 19, 2017 was assessed. On that day, a total of 5,504 POVs entered the facility through the seven POV booths. **Figure H** shows the flux of volume by hour.

Figure H: Hourly POV Volumes on October 19, 2017



To capture both POV and COV performance in the VISSIM model, the time window between 9am and 3pm was coded into the model. However, without any data regarding arrival information for POVs entering the queue – the actual hourly demand – traffic engineering judgement had to be used to determine the demand. An assumed factor of 1.3 times the actual processed volume was used to calculate a higher demand volume. For consistency, the same methodology was used for POVs, COVs, and PEDs.

Table 2.1 displays the actual volumes of processed POVs per hour on October 19, 2017, as well as the estimated demand volume calculated by applying the factor of 1.3, for all hours between 9am and 3pm. **Table 2.2** shows the same for COVs. **Table 2.3** shows the actual volume of processed PEDs during the peak hour on October 19, 2017, and the demand volume calculated by applying the factor of 1.3.

Table 2.1: Hourly POV Volumes on October 19, 2017

Time Frame	Processed Volume	Demand Volume
9am-10am	359	467
10am-11am	310	403
11am-12pm	296	385
12pm-1pm	320	416
1pm-2pm	321	417
2pm-3pm	313	407

Table 2.2: Hourly COV Volumes on October 19, 2017

Time Frame	Processed Volume	Demand Volume
9am-10am	15	20
10am-11am	15	20
11am-12pm	13	17
12pm-1pm	14	18
1pm-2pm	17	22
2pm-3pm	24	31

Table 2.3: Hourly PED Volumes on October 19, 2017

Time Frame	Processed Volume	Demand Volume
7am-8am	295	384

2.1.1 Computing Growth Rates

The next step in the analysis is determining growth rates to calculate projected volumes for 2018 and 2043.

Using total yearly volumes from 2011 through 2017 for each mode of transportation as shown in **Table 2.4**, a cumulative compound annual growth rate (CAGR) was determined for use in projecting future volumes.

Table 2.4: Yearly Inbound Processed Volumes

Travel Mode	2011	2012	2013	2014	2015	2016	2017
POV	1,393,181	1,405,122	1,470,933	1,571,929	1,716,303	1,614,882	1,765,505
COV	29,883	31,636	32,497	33,104	34,545	30,815	30,649
PED	1,030,357	1,198,838	1,804,110	1,011,564	1,121,717	851,997	854,502
Total	2,453,421	2,635,596	3,307,540	2,616,597	2,872,565	2,497,694	2,650,656

To find the compound annual growth rate (CAGR):

V_f = final volume = 2,650,656

V_i = initial volume = 2,453,421

N = number of years = 7

CAGR = $(V_f/V_i)^{(1/N)} - 1 = (2{,}650{,}656 / 2{,}453{,}421)^{(1/7)} - 1 = 0.011$ – or **1.1%**

The same growth rate of 1.1% is assumed for all modes: PED, POV, and COV.

2.1.2 Determining 2018 Baseline Demand

After converting the 2017 processed volumes to 2017 demand volumes using the factor of 1.3, the CAGR of 1.1% can be used to calculate the projected 2018 demand volumes using the peak day of October 19, 2017 as a baseline. **Table 2.5** displays side-by-side the daily 2017 processed volumes, 2017 demand volumes, and 2018 demand volumes for all modes.

Table 2.5: Inbound Daily Border Crossing Volumes

Travel Mode	2017 Processed Volume	2017 Demand Volume	2018 Demand Volume
POV	5,504	7,155	7,234
COV	129	168	170
PED	2,266	2,946	2,978

Focusing in on the peak period used in the VISSIM model for the 2018 Baseline Scenario, the CAGR was applied to the hourly 2017 demand volumes previously discussed in **Section 2.0**. These new hourly 2018 demand volumes are presented below in **Table 2.6** for 9am to 3pm for POVs and COVs and for the single peak hour for PEDs.

Figure J: 22-Year Inbound COV Processing Trends

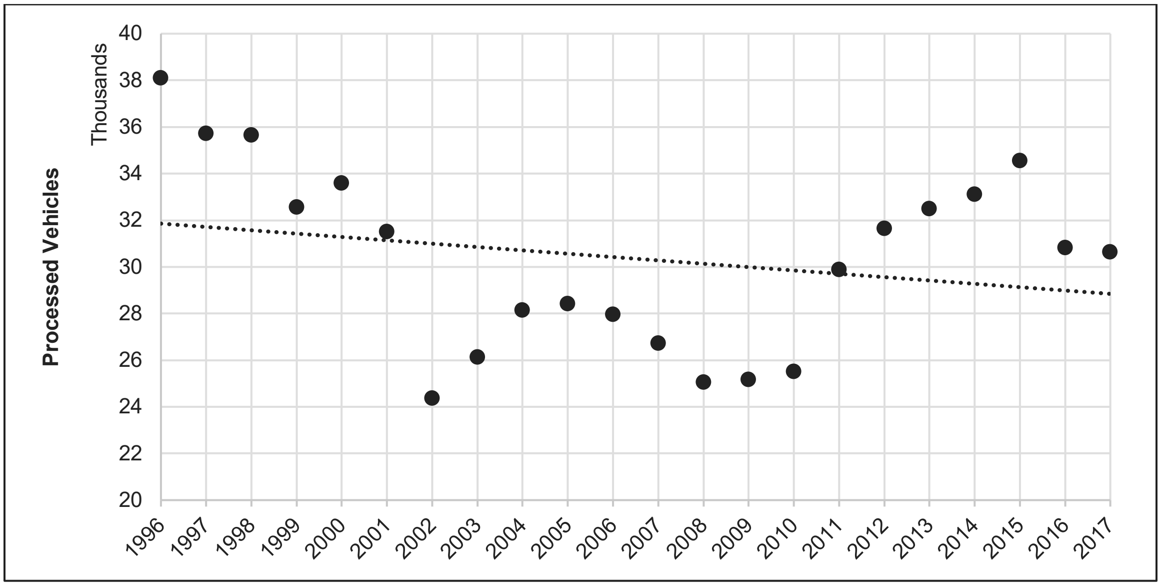
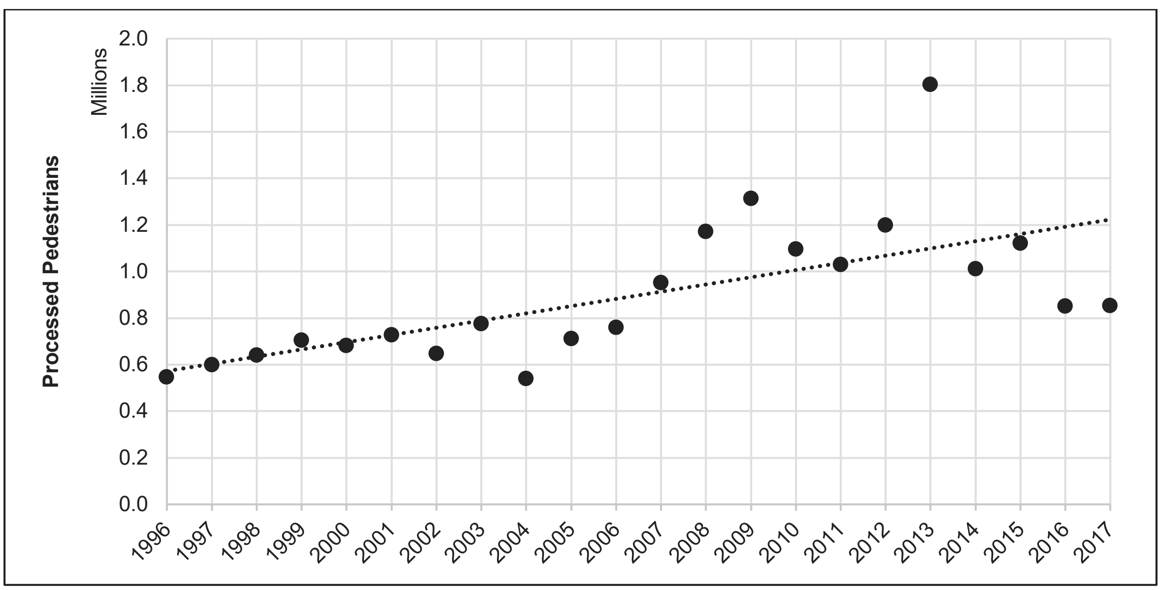


Figure K: 22-Year Inbound PED Processing Trends



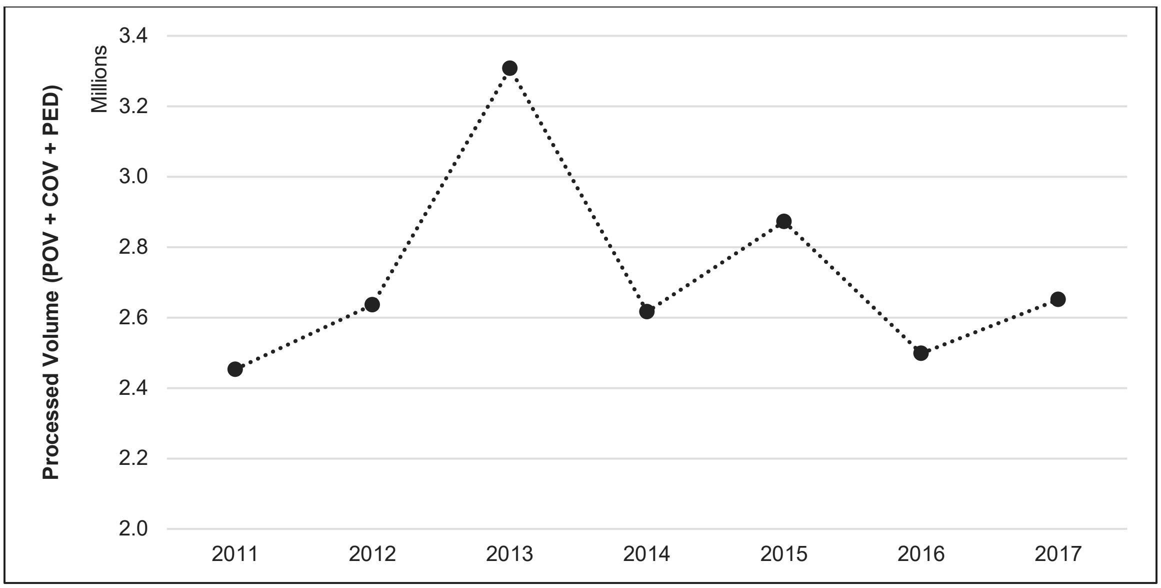
3.1.2 Growth Trends

Results from the 1996 to 2017 border crossing data yielded negative growth for both POV's and COV's. Volumes decreased significantly during the early 2000's which led to skewed data. Various historical events could be seen as large contributing factors to the decline in the three modes of transportation (POV, COV, and PED) during this time.

In December of 2006, Mexican President Felipe Calderon deployed troops to the City of Michoacan, in hopes of regaining control over the area and fighting back against Mexican drug cartels. Although this was the first time that war was officially declared, violence due to drug related matters had begun to surge a couple years earlier. As this issue became recognized worldwide, overall travel into and out of Mexico subsequently dropped (*“Mexico’s war on drugs: what has it achieved and how is the US involved”, The Guardian, Nina Lakhani, Dec 8 2016*).

Given this major impact on the observed volumes, only the years between 2011-2017 were used to compute future growth rates, as described in Section 2.1.1). Since this seven-year period is the most recent data set showing growth, it was determined to be the most pertinent to this study. When these seven years are isolated, growth was noticed amongst all modes. The figure below represents the actual inbound combined total volume of POVs, COVs, and PEDs that entered the USA via the Douglas LPOE from 2011 to 2017.

Figure L: 7-Year Inbound Combined Processing Trends



The CAGR of 1.1% can be applied to the previously determined daily 2017 processed volumes from October 19, 2017 to calculate volumes for POVs, COVs, and PEDs for the horizon year 2043. These estimated future processing volumes are shown below in **Table 3.1**.

Table 3.1: Present and Future Year Inbound Daily Processing Volumes (not Demand)

Travel Mode	October 19, 2017	Projected 2018	Projected 2043	% Growth (2017 – 2043)
POV	5,504	5,565	7,315	32.9%
COV	129	130	171	
PED	2,266	2,291	3,012	

Appendix 2. ADOT Commercial Inspection Facility Data

Douglas State Port Of Entry Stats

January - December 2020

Permits:
Number of Trucks: 2578
Total CVSA inspections for the year: 72

CVSA Inspection: January: 8
February: 30
March: 0
April: 1
May: 0
June: 1
July: 9
August: 6
September: 6
October: 5
November: 4
December: 2

January - December 2021

Permits: 21
Number of Trucks: 2992
Total CVSA inspections for the year: 115

Number of Trucks: January: 391
February: 267
March: 312
April: 375
May: 178
June: 303
July: 242
August: 254
September: 152
October: 233
November: 117
December: 168

CVSA Inspection: January: 1
February: 10
March: 16
April: 15
May: 10

June: 15
July: 14
August: 12
September: 9
October: 5
November: 5
December: 3

January - December 2022

Permits: 6
Number of Trucks: 1816
Total CVSA inspections for the year: 80

Number of trucks: January: 227
February: 229
March: 253
April: 242
May: 153
June: 223
July: 188
August: 132
September: 104
October: 169
November: 27
December: 70
CVSA Inspection: January: 6
February: 13
March: 10
April: 3
May: 5
June: 12
July: 6
August: 10
September: 6
October: 5
November: 2
December: 2

Appendix 3. Collected Traffic Volume Data

Location Info	
Location ID	100871
Type	LINK
Functional Class	3
Located On	SR 80
Between	Paul Spur Rd AND US 191 - West of Douglas
Direction	2-WAY
Community	Cochise
MPO_ID	1
HPMS ID	
Agency	Arizona Department of Transportation

Count Data Info	
Start Date	12/7/2021
End Date	12/8/2021
Start Time	12:00 AM
End Time	12:00 AM
Direction	
Notes	adot
Count Source	DOUGLAS00000
File Name	
Weather	
Study	
Owner	adot
QC Status	Accepted

Interval: 15 mins

Time	15 Min				Hourly Count
	1st	2nd	3rd	4th	
00:00 - 01:00	7	11	7	9	34
01:00 - 02:00	2	2	4	0	8
02:00 - 03:00	3	3	0	2	8
03:00 - 04:00	7	4	6	16	33
04:00 - 05:00	11	19	16	19	65
05:00 - 06:00	32	51	78	58	219
06:00 - 07:00	51	82	71	60	264
07:00 - 08:00	78	84	100	113	375
08:00 - 09:00	77	77	85	110	349
09:00 - 10:00	128	72	79	78	357
10:00 - 11:00	85	69	99	90	343
11:00 - 12:00	83	67	76	104	330
12:00 - 13:00	98	83	72	106	359
13:00 - 14:00	94	104	116	84	398
14:00 - 15:00	119	81	99	104	403
15:00 - 16:00	128	113	120	110	471
16:00 - 17:00	107	111	113	112	443
17:00 - 18:00	99	132	94	73	398
18:00 - 19:00	54	51	63	54	222
19:00 - 20:00	62	45	34	34	175
20:00 - 21:00	45	42	33	28	148
21:00 - 22:00	18	35	38	24	115
22:00 - 23:00	33	21	18	16	88
23:00 - 24:00	22	17	14	9	62
TOTAL					5667

Location Info	
Location ID	102213
Type	LINK
Functional Class	4
Located On	US 191
Between	SR 80 AND Glenn Rd
Direction	2-WAY
Community	Cochise
MPO_ID	0
HPMS ID	
Agency	Arizona Department of Transportation

Count Data Info	
Start Date	10/20/2020
End Date	10/21/2020
Start Time	12:15 PM
End Time	12:15 PM
Direction	
Notes	adot
Count Source	1.4773E+11
File Name	102213300110_147730000009_10191215.prn
Weather	
Study	
Owner	adot
QC Status	Accepted

Interval: 15 mins

Time	15 Min				Hourly Count
	1st	2nd	3rd	4th	
00:00 - 01:00	4	3	1	1	9
01:00 - 02:00	3	3	4	2	12
02:00 - 03:00	6	2	5	6	19
03:00 - 04:00	0	5	14	23	42
04:00 - 05:00	12	20	17	30	79
05:00 - 06:00	40	57	43	32	172
06:00 - 07:00	49	56	67	67	239
07:00 - 08:00	42	57	59	75	233
08:00 - 09:00	45	44	40	44	173
09:00 - 10:00	43	53	55	58	209
10:00 - 11:00	40	54	52	48	194
11:00 - 12:00	46	46	60	49	201
12:00 - 13:00	73	48	63	68	252
13:00 - 14:00	61	78	62	87	288
14:00 - 15:00	115	61	78	72	326
15:00 - 16:00	74	63	76	55	268
16:00 - 17:00	72	63	71	65	271
17:00 - 18:00	64	60	38	47	209
18:00 - 19:00	45	31	25	41	142
19:00 - 20:00	42	31	20	20	113
20:00 - 21:00	24	16	20	28	88
21:00 - 22:00	18	28	8	19	73
22:00 - 23:00	38	6	5	9	58
23:00 - 24:00	5	1	1	4	11
TOTAL					3681

Location Info	
Location ID	100872
Type	LINK
Functional Class	3
Located On	SR 80
Between	US 191 - West of Douglas AND Chino Rd
Direction	2-WAY
Community	Cochise
MPO_ID	0
HPMS ID	VHKCRHTC2014
Agency	Arizona Department of Transportation

Count Data Info	
Start Date	7/13/2021
End Date	7/14/2021
Start Time	12:30 PM
End Time	12:30 PM
Direction	2-WAY
Notes	adot
Count Source	1.47734E+11
File Name	
Weather	
Study	
Owner	adot
QC Status	Accepted

Interval: 15 mins

Time	15 Min				Hourly Count
	1st	2nd	3rd	4th	
00:00 - 01:00	9	15	9	8	41
01:00 - 02:00	6	16	11	2	35
02:00 - 03:00	8	13	11	22	54
03:00 - 04:00	26	14	24	44	108
04:00 - 05:00	48	33	42	50	173
05:00 - 06:00	68	132	101	89	390
06:00 - 07:00	101	108	130	143	482
07:00 - 08:00	114	115	150	154	533
08:00 - 09:00	101	110	107	110	428
09:00 - 10:00	103	140	125	110	478
10:00 - 11:00	120	135	125	108	488
11:00 - 12:00	126	138	165	151	580
12:00 - 13:00	149	149	152	158	608
13:00 - 14:00	159	146	178	162	645
14:00 - 15:00	192	177	175	179	723
15:00 - 16:00	164	147	156	145	612
16:00 - 17:00	171	166	154	167	658
17:00 - 18:00	186	152	126	134	598
18:00 - 19:00	101	98	77	75	351
19:00 - 20:00	69	57	61	68	255
20:00 - 21:00	64	53	55	54	226
21:00 - 22:00	56	70	48	40	214
22:00 - 23:00	74	34	35	22	165
23:00 - 24:00	31	33	12	20	96
TOTAL					8941

Location Info	
Location ID	100876
Type	LINK
Functional Class	4
Located On	SR 80
Between	US 191B / G Ave - Douglas AND A Ave / Leslie Canyon / Fairgrounds Rd
Direction	2-WAY
Community	DOUGLAS
MPO_ID	0
HPMS ID	S00004883101
Agency	Arizona Department of Transportation

Count Data Info	
Start Date	7/13/2021
End Date	7/14/2021
Start Time	1:30 PM
End Time	1:30 PM
Direction	
Notes	adot
Count Source	1.36973E+11
File Name	
Weather	
Study	
Owner	adot
QC Status	Accepted

Interval: 15 mins

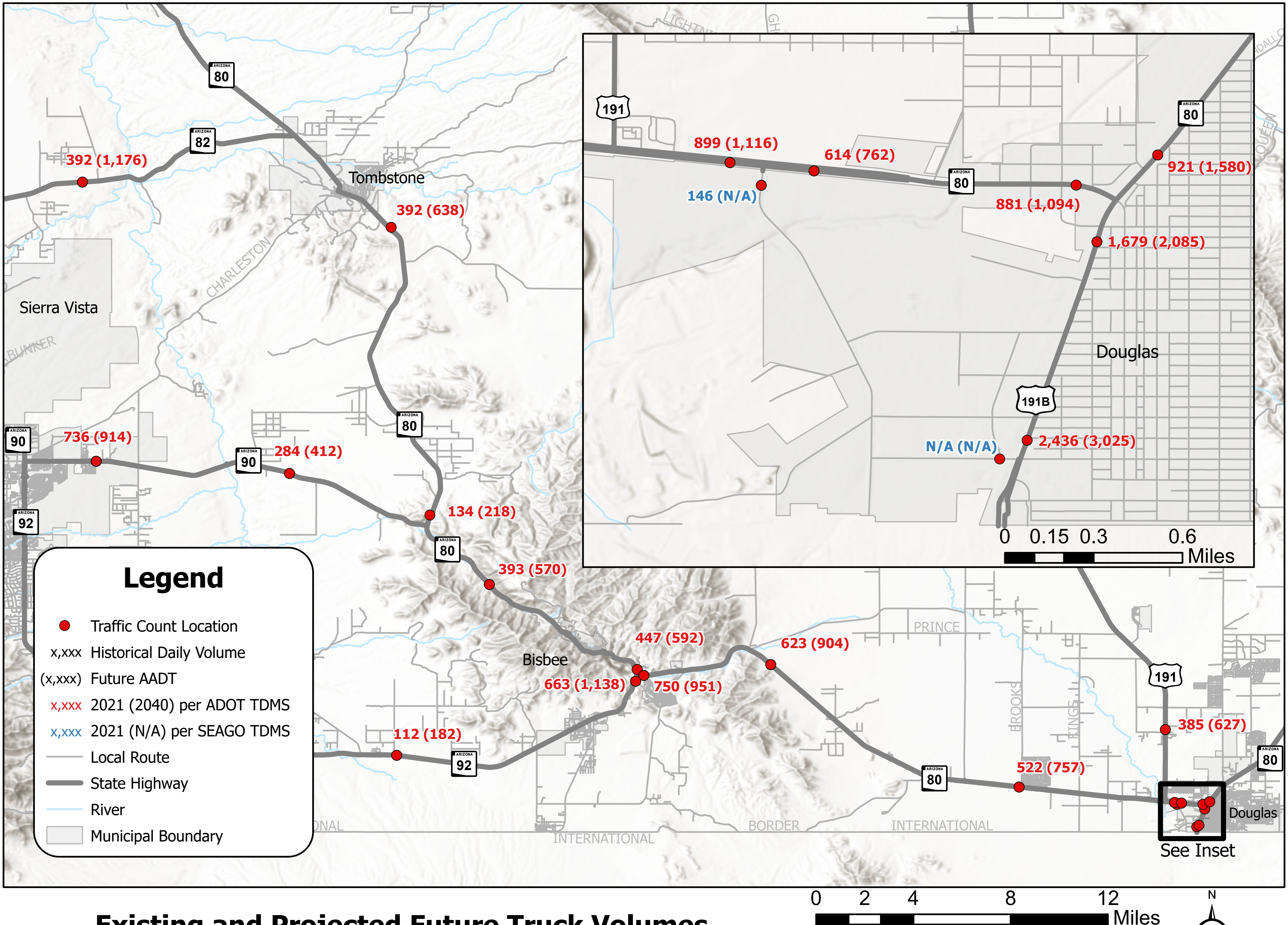
Time	15 Min				Hourly Count
	1st	2nd	3rd	4th	
00:00 - 01:00	8	5	2	6	21
01:00 - 02:00	5	6	3	1	15
02:00 - 03:00	1	1	2	4	8
03:00 - 04:00	13	0	2	10	25
04:00 - 05:00	4	4	11	8	27
05:00 - 06:00	22	22	19	33	96
06:00 - 07:00	21	24	24	29	98
07:00 - 08:00	23	25	27	48	123
08:00 - 09:00	33	53	46	50	182
09:00 - 10:00	44	34	47	52	177
10:00 - 11:00	35	46	30	41	152
11:00 - 12:00	39	45	43	40	167
12:00 - 13:00	56	42	43	69	210
13:00 - 14:00	72	62	56	60	250
14:00 - 15:00	51	49	60	47	207
15:00 - 16:00	51	45	37	40	173
16:00 - 17:00	44	46	51	68	209
17:00 - 18:00	57	36	57	46	196
18:00 - 19:00	40	39	36	29	144
19:00 - 20:00	36	31	29	23	119
20:00 - 21:00	37	30	23	29	119
21:00 - 22:00	29	33	24	31	117
22:00 - 23:00	18	11	11	11	51
23:00 - 24:00	13	13	7	7	40
TOTAL					2926

Location Info	
Location ID	c02234
Type	I-SECTION
Functional Class	4
Located On	N Chino Rd
BETWEEN	W Highway 80 EB
Direction	2-WAY
Community	Douglas West
MPO_ID	
HPMS ID	
Agency	SouthEastern Arizona Governments Organization

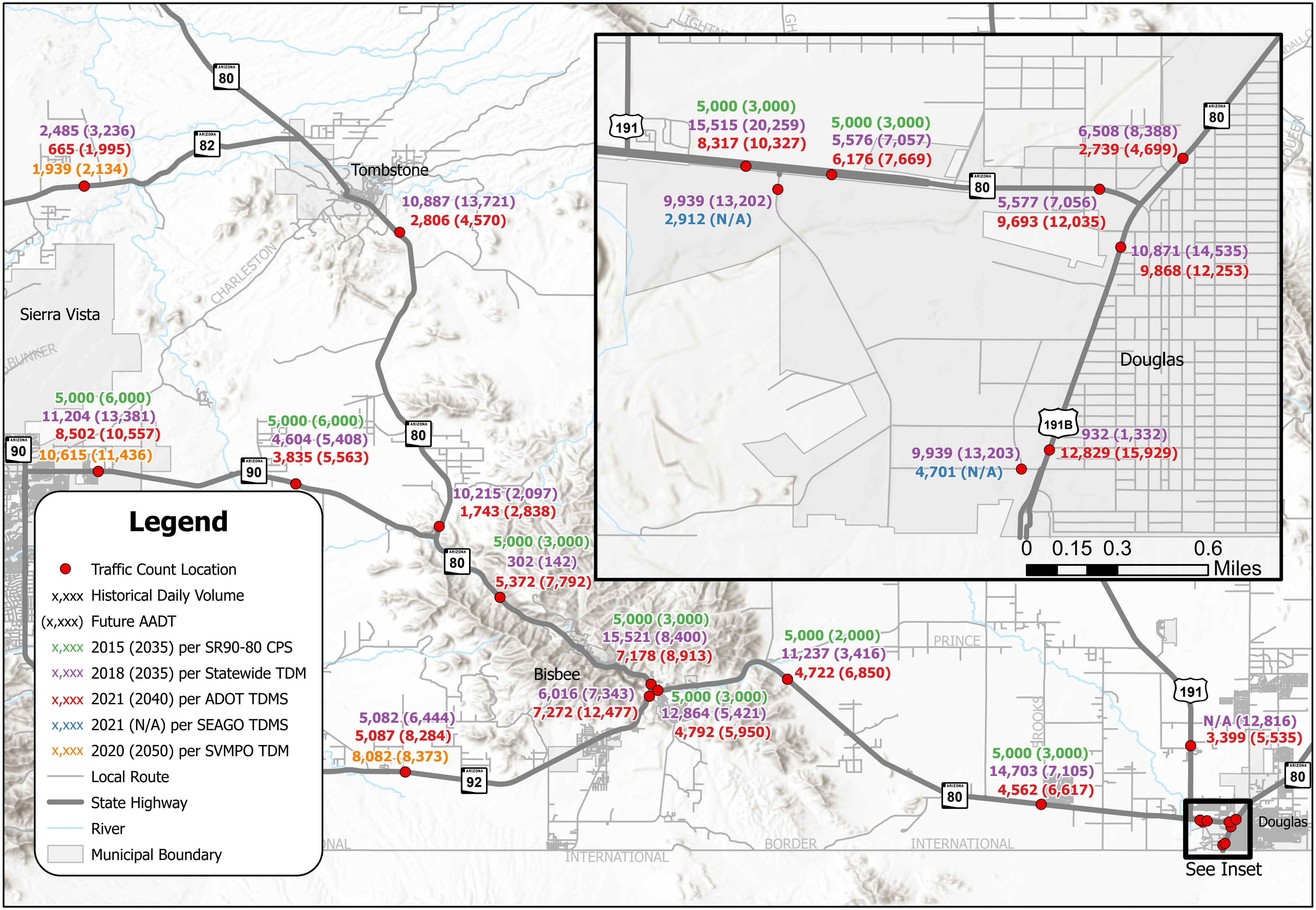
Count Data Info	
Start Date	6/5/2018
End Date	6/6/2018
Start Time	12:00 AM
End Time	12:00 AM
Direction	2-WAY
Notes	seago
Count Source	2234
File Name	c02234_vol.prn
Weather	
Study	
Owner	adam
QC Status	Accepted

Interval: 15 mins

Time	15 Min				Hourly Count
	1st	2nd	3rd	4th	
00:00 - 01:00	8	2	4	3	17
01:00 - 02:00	3	4	3	1	11
02:00 - 03:00	1	2	1	3	7
03:00 - 04:00	1	2	3	2	8
04:00 - 05:00	5	5	7	10	27
05:00 - 06:00	19	11	14	20	64
06:00 - 07:00	12	24	22	24	82
07:00 - 08:00	44	34	45	41	164
08:00 - 09:00	49	32	57	31	169
09:00 - 10:00	36	40	30	40	146
10:00 - 11:00	35	42	58	45	180
11:00 - 12:00	39	52	47	45	183
12:00 - 13:00	62	62	44	47	215
13:00 - 14:00	52	48	35	39	174
14:00 - 15:00	45	43	63	44	195
15:00 - 16:00	69	56	46	46	217
16:00 - 17:00	45	40	50	54	189
17:00 - 18:00	60	55	63	64	242
18:00 - 19:00	42	36	35	32	145
19:00 - 20:00	33	37	38	31	139
20:00 - 21:00	26	22	33	21	102
21:00 - 22:00	29	28	25	15	97
22:00 - 23:00	35	15	20	5	75
23:00 - 24:00	9	8	4	2	23
TOTAL					2871



Existing and Projected Future Truck Volumes

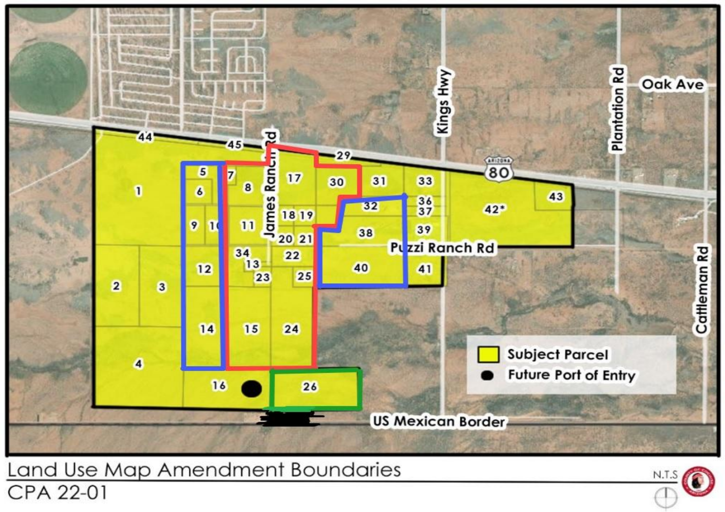


Existing and Projected Future Daily Vehicle Volumes

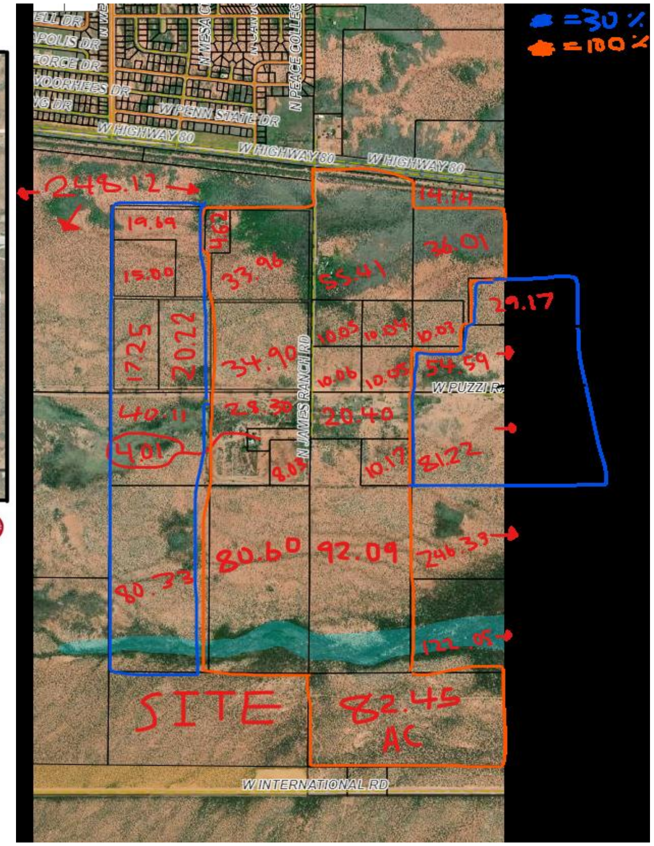
Appendix 4. Volume Development Calculations

	TOTAL AREA (ACRES):		
	100%	30%	
	82.45	81.22	
	92.09	54.59	
	10.17	29.17	
	20.4	80.33	
	10.06	40.11	
	10.05	17.25	
	10.05	20.22	
	10.04	15	
	10.03	19.69	
	55.41		
	36.01		
	80.6		
	8.03		
	28.3		
	4.01		
	34.9		
	33.96		
	4.62		
TOTAL AC	541.18	357.58	
TOTAL SF	23573800.8	15576184.8	
ADJUSTED SF	23573800.8	4672855.44	648.454
FAR	0.25		
FLOOR AREA	5893450.2	1168213.86	
GRAND TOTAL SF	7061664.06		7061.664 <- (KSF)

Figure 2: Subject Parcels Map



100% of Red/Green + 30% of blue assumed



Trip Generation Planner (ITE 11th Edition) - Summary Report

Kimley»Horn

Weekday Trip Generation
Trips Based on Average Rates/Equations

Project Name **Douglas IPOE Connector Road**
Project Number **096552002**

							Rates			Total Trips						
ITE Code	**Internal Capture Land Use**	**Land Use Description**	**Independent Variable**	**Setting/Location**	**No. of Units**	**Avg Rate or Eq**	**Daily Rate**	**AM Rate**	**PM Rate**	**Daily Trips**	**AM Trips**	**PM Trips**	**AM Trips In**	**AM Trips Out**	**PM Trips In**	**PM Trips Out**
150	Select Use	Warehousing	1,000 Sq Ft	General Urban/Suburban	7061.7	Avg	1.71	0.21	0.23	12,076	1,483	1,624	979	504	390	1,234

Data from Stantec Report

(Trips *entering* USA)

Overall Daily Peak Hr

Daily Peak Hr within open hrs (9am-5pm)	9-10am	
	Processed	Demand
Daily Peak Hr Passenger Cars (POVs)	374	486
Daily Peak Hr Trucks (COVs)	15	20

Truck Daily Peak Hr

Daily Peak Hr within open hrs (9am-5pm)	2-3pm		
	Processed	Demand	
Daily Peak Hr Passenger Cars (POVs)	313	407	
Daily Peak Hr Trucks (COVs)	24	31	<- trips generated by POE will be trucks only

DEMAND FACTOR:	1.3

Adjacent Site Trip Generation

ITE LU 150 (Warehousing)
*AM/PM Peak Hour of Generator

Land Use Summary (see Adjacent Site Trip Gen spreadsheet for details)

Total Acres (adjusted)	648.454	AC
FAR	0.25	
Total Building Area	7061.664	KSF

HORIZON TRIP GEN:	In	Out	Total
AM	979	504	1483
PM	390	1234	1624
Daily	6038	6037	12075

	Rate	% In	% Out
AM	0.21	0.66	0.34
PM	0.23	0.24	0.76
Daily	1.71	0.5	0.5

Estimated Total Intersection Hourly Volume

James Ranch Rd & SR 80 (Intersection 1)	NB L	NB T	NB R	SB L	SB T	SB R	EB L	EB T	EB R	WB L	WB T	WB R	Factors	Notes
AM Peak Hr Existing Tfc	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*111*	*0*	*0*	*264*	*0*		
PM Peak Hr Existing Tfc	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*267*	*0*	*0*	*204*	*0*		
POE Peak Hr Asmt (To ADOT Int'l POE)			31								14		100%	=% of Int'l POE traffic that must turn NBR to go to State POE
POE Peak Hr Asmt (Remainder)	0		0						14	17				
Adjacent Site Asmt - AM Opening	23		129						44	250			30%	=% of adjacent site built by Site Buildout
Adjacent Site Asmt - PM Opening	56		315						18	99				
Adjacent Site Asmt - AM Horizon	76		428						147	832				
Adjacent Site Asmt - PM Horizon	185		1049						59	332				

WAREHOUSING DISTRIBUTION	
<- To/From West	To/From East ->
15%	85%

POE Truck Distribution

	IN (SB)	OUT (NB)	USE
ADT	30%	30%	30%
Daily Peak Hr	29%	34%	
AM Peak Hr	35%	26%	
PM Peak Hr	27%	30%	

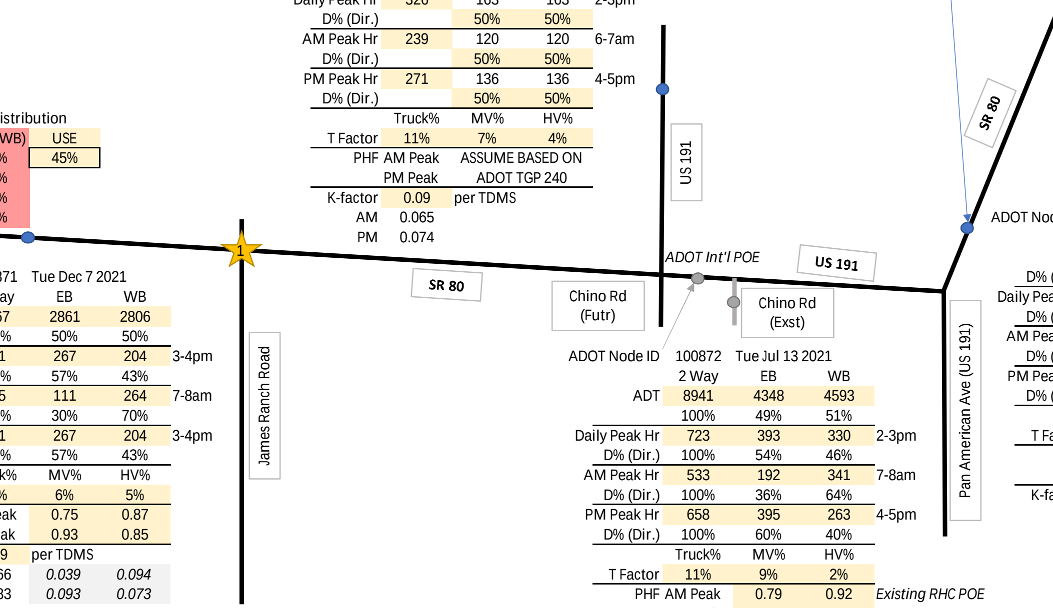
POE Truck Distribution

	IN (WB)	OUT (EB)	USE
ADT	23%	24%	25%
Daily Peak Hr	24%	24%	
AM Peak Hr	32%	16%	
PM Peak Hr	19%	25%	

POE Truck Distribution

	IN (EB)	OUT (WB)	USE
ADT	47%	46%	45%
Daily Peak Hr	47%	42%	
AM Peak Hr	33%	58%	
PM Peak Hr	54%	45%	

ADOT Node ID	102213	Tue Oct 20 2020		
	2 Way	NB	SB	
ADT	3681	1841	1841	
D% (Dir.)		50%	50%	
Daily Peak Hr	326	163	163	2-3pm
D% (Dir.)		50%	50%	
AM Peak Hr	239	120	120	6-7am
D% (Dir.)		50%	50%	
PM Peak Hr	271	136	136	4-5pm
D% (Dir.)		50%	50%	
	Truck%	MV%	HV%	
T Factor	11%	7%	4%	
PHF	AM Peak	ASSUME BASED ON		
	PM Peak	ADOT TGP 240		
K-factor	0.09	per TDMS		
AM	0.065			
PM	0.074			



ADOT Node ID	100871	Tue Dec 7 2021		
	2 Way	EB	WB	
ADT	5667	2861	2806	
D% (Dir.)	100%	50%	50%	
Daily Peak Hr	471	267	204	3-4pm
D% (Dir.)	100%	57%	43%	
AM Peak Hr	375	111	264	7-8am
D% (Dir.)	100%	30%	70%	
PM Peak Hr	471	267	204	3-4pm
D% (Dir.)	100%	57%	43%	
	Truck%	MV%	HV%	
T Factor	11%	6%	5%	
PHF	AM Peak	0.75	0.87	
	PM Peak	0.93	0.85	
K-factor	0.09	per TDMS		
AM	0.066	*0.039*	*0.094*	
PM	0.083	*0.093*	*0.073*	

ADOT Node ID	100872	Tue Jul 13 2021		
	2 Way	EB	WB	
ADT	8941	4348	4593	
	100%	49%	51%	
Daily Peak Hr	723	393	330	2-3pm
D% (Dir.)	100%	54%	46%	
AM Peak Hr	533	192	341	7-8am
D% (Dir.)	100%	36%	64%	
PM Peak Hr	658	395	263	4-5pm
D% (Dir.)	100%	60%	40%	
	Truck%	MV%	HV%	
T Factor	11%	9%	2%	
PHF	AM Peak	0.79	0.92	
	PM Peak	0.96	0.94	
K-factor	0.08	per TDMS		
AM	0.060	*0.044*	*0.074*	
PM	0.074	*0.091*	*0.057*	

ADOT Node ID	100876	Tue Jul 13 2021		
	2 Way	EB	WB	
ADT	2926	1491	1435	
D% (Dir.)	100%	51%	49%	
Daily Peak Hr	250	115	135	1-2pm
D% (Dir.)	100%	46%	54%	
AM Peak Hr	182	74	108	8-9am
D% (Dir.)	100%	41%	59%	
PM Peak Hr	209	113	96	4-5pm
D% (Dir.)	100%	54%	46%	
	Truck%	MV%	HV%	
T Factor	34%	20%	14%	
PHF	AM Peak	0.64	0.73	
	PM Peak	0.74	0.80	
K-factor	0.08	per TDMS		
AM	0.062	*0.050*	*0.075*	
PM	0.071	*0.076*	*0.067*	

NEW POE

	To MX	To USA	
POE Base Trip Gen	31	31	vph
HORIZON Adjacent Sites AM	979	504	vph
HORIZON Adjacent Sites PM	390	1234	vph

Estimated Total Intersection Hourly Volume

US 191 & SR 80 (Intersection 2)	NB L	NB T	NB R	SB L	SB T	SB R	EB L	EB T	EB R	WB L	WB T	WB R	Factors	Notes
AM Peak Hr Existing Tfc	0	0	0	75	0	45	32	79	0	0	205	136		
PM Peak Hr Existing Tfc	0	0	0	85	0	51	76	191	0	0	158	105		
POE Peak Hr Asmt (To ADOT Int'l POE)	0	0	0	17	0	14	31	*0*	0	0	*0*	0		
Adjacent Site Asmt - AM Opening	0	0	0	*0*	0	37	19	109	0	0	212	*0*		
Adjacent Site Asmt - PM Opening	0	0	0	*0*	0	15	47	267	0	0	85	*0*		
Adjacent Site Asmt - AM Horizon	0	0	0	*0*	0	125	64	364	0	0	707	*0*		
Adjacent Site Asmt - PM Horizon	0	0	0	*0*	0	50	157	892	0	0	282	*0*		
Chino Rd Rerouting AM	42	30	4	-40	40	0	0	-55	55	5	-42	-30		
Chino Rd Rerouting PM	43	31	4	-69	69	0	0	-95	95	9	-43	-31		

SEAGO Node ID	c02234	Tue Jun 5 2018*		
	2 Way	NB	SB	
ADT	2976	1305	1671	
	100%	44%	56%	
Daily Peak Hr	251	78	173	5-6pm
D% (Dir.)	100%	31%	69%	
AM Peak Hr	175	76	100	8-9am
D% (Dir.)	100%	43%	57%	
PM Peak Hr	251	78	173	5-6pm
D% (Dir.)	100%	31%	69%	
	Truck%			
T Factor	5%			
PHF AM Peak		0.79	0.71	
PM Peak		0.99	0.93	
K-factor	0.09	per TDMS		
AM	0.059	0.058	0.060	
PM	0.084	0.060	0.104	
	NBL	NBT	NBR	
Split %:	55%	40%	5%	

*2018 volumes grown to match 2022 ADT:		
2018 ADT	2022 ADT	Growth Factor
2871	2976	1.037

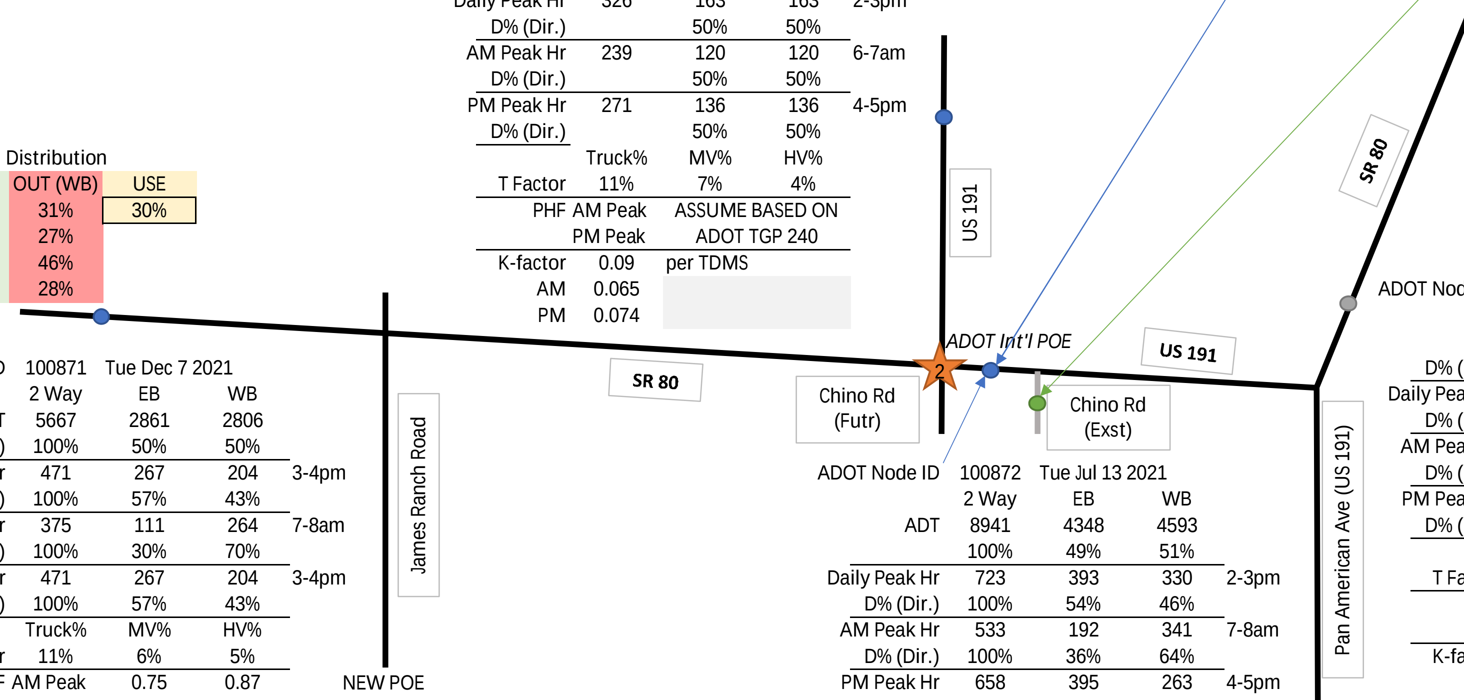
Distribution	IN (SB)	OUT (NB)	USE
ADT	20%	20%	20%
Daily Peak Hr	21%	21%	
AM Peak Hr	21%	21%	
PM Peak Hr	20%	18%	

Distribution	IN (WB)	OUT (EB)	USE
ADT	49%	48%	50%
Daily Peak Hr	43%	52%	
AM Peak Hr	60%	33%	
PM Peak Hr	40%	54%	

WAREHOUSING DISTRIBUTION	
To/From US 191	To/From US 80
15%	85%

ADOT Node ID	102213	Tue Oct 20 2020		
	2 Way	NB	SB	
ADT	3681	1841	1841	
D% (Dir.)		50%	50%	
Daily Peak Hr	326	163	163	2-3pm
D% (Dir.)		50%	50%	
AM Peak Hr	239	120	120	6-7am
D% (Dir.)		50%	50%	
PM Peak Hr	271	136	136	4-5pm
D% (Dir.)		50%	50%	
	Truck%	MV%	HV%	
T Factor	11%	7%	4%	
PHF AM Peak		ASSUME BASED ON		
PM Peak		ADOT TGP 240		
K-factor	0.09	per TDMS		
AM	0.065			
PM	0.074			

Distribution	IN (EB)	OUT (WB)	USE
ADT	31%	31%	30%
Daily Peak Hr	35%	27%	
AM Peak Hr	19%	46%	
PM Peak Hr	40%	28%	



ADOT Node ID	100871	Tue Dec 7 2021		
	2 Way	EB	WB	
ADT	5667	2861	2806	
D% (Dir.)	100%	50%	50%	
Daily Peak Hr	471	267	204	3-4pm
D% (Dir.)	100%	57%	43%	
AM Peak Hr	375	111	264	7-8am
D% (Dir.)	100%	30%	70%	
PM Peak Hr	471	267	204	3-4pm
D% (Dir.)	100%	57%	43%	
	Truck%	MV%	HV%	
T Factor	11%	6%	5%	
PHF AM Peak		0.75	0.87	
PM Peak		0.93	0.85	
K-factor	0.09	per TDMS		
AM	0.066	*0.039*	*0.094*	
PM	0.083	*0.093*	*0.073*	

ADOT Node ID	100872	Tue Jul 13 2021		
	2 Way	EB	WB	
ADT	8941	4348	4593	
	100%	49%	51%	
Daily Peak Hr	723	393	330	2-3pm
D% (Dir.)	100%	54%	46%	
AM Peak Hr	533	192	341	7-8am
D% (Dir.)	100%	36%	64%	
PM Peak Hr	658	395	263	4-5pm
D% (Dir.)	100%	60%	40%	
	Truck%	MV%	HV%	
T Factor	11%	9%	2%	
PHF AM Peak		0.79	0.92	
PM Peak		0.96	0.94	
K-factor	0.08	per TDMS		
AM	0.060	*0.044*	*0.074*	

ADOT Node ID	100876	Tue Jul 13 2021		
	2 Way	EB	WB	
ADT	2926	1491	1435	
D% (Dir.)	100%	51%	49%	
Daily Peak Hr	250	115	135	1-2pm
D% (Dir.)	100%	46%	54%	
AM Peak Hr	182	74	108	8-9am
D% (Dir.)	100%	41%	59%	
PM Peak Hr	209	113	96	4-5pm
D% (Dir.)	100%	54%	46%	
	Truck%	MV%	HV%	
T Factor	34%	20%	14%	
PHF AM Peak		0.64	0.73	
PM Peak		0.74	0.80	
K-factor	0.08	per TDMS		
AM	0.062	*0.050*	*0.075*	
PM	0.071	*0.076*	*0.067*	

Truck % by Movement

James Ranch Rd & SR 80 (Intersection 1)	NB L	NB T	NB R	SB L	SB T	SB R	EB L	EB T	EB R	WB L	WB T	WB R
AM Peak Hr Existing Tfc	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
PM Peak Hr Existing Tfc	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
POE Peak Hr Asmt (To ADOT Int'l POE)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
POE Peak Hr Asmt (Remainder)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adjacent Site Asmt - AM Opening	20%	2%	20%	2%	2%	2%	2%	2%	20%	20%	2%	2%
Adjacent Site Asmt - PM Opening	20%	2%	20%	2%	2%	2%	2%	2%	20%	20%	2%	2%
Adjacent Site Asmt - AM Horizon	20%	2%	20%	2%	2%	2%	2%	2%	20%	20%	2%	2%
Adjacent Site Asmt - PM Horizon	20%	2%	20%	2%	2%	2%	2%	2%	20%	20%	2%	2%
US 191 & SR 80 (Intersection 2)	**NB L**	**NB T**	**NB R**	**SB L**	**SB T**	**SB R**	**EB L**	**EB T**	**EB R**	**WB L**	**WB T**	**WB R**
AM Peak Hr Existing Tfc	5%	5%	5%	11%	5%	11%	11%	11%	5%	5%	11%	11%
PM Peak Hr Existing Tfc	5%	5%	5%	11%	5%	11%	11%	11%	5%	5%	11%	11%
POE Peak Hr Asmt (To ADOT Int'l POE)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adjacent Site Asmt - AM Opening	2%	2%	2%	20%	2%	20%	20%	20%	2%	2%	20%	20%
Adjacent Site Asmt - PM Opening	2%	2%	2%	20%	2%	20%	20%	20%	2%	2%	20%	20%
Adjacent Site Asmt - AM Horizon	2%	2%	2%	20%	2%	20%	20%	20%	2%	2%	20%	20%
Adjacent Site Asmt - PM Horizon	2%	2%	2%	20%	2%	20%	20%	20%	2%	2%	20%	20%

HV% Override: 5%

MV% Override: 0%

Medium Vehicle % by Movement

James Ranch Rd & SR 80 (Intersection 1)	NB L	NB T	NB R	SB L	SB T	SB R	EB L	EB T	EB R	WB L	WB T	WB R
AM Peak Hr Existing Tfc								6%			6%	
PM Peak Hr Existing Tfc								6%			6%	
POE Peak Hr Asmt (To ADOT Int'l POE)												
POE Peak Hr Asmt (Remainder)												
Adjacent Site Asmt - AM Opening	6%		6%						6%	6%		
Adjacent Site Asmt - PM Opening	6%		6%						6%	6%		
Adjacent Site Asmt - AM Horizon	6%		6%						6%	6%		
Adjacent Site Asmt - PM Horizon	6%		6%						6%	6%		
US 191 & SR 80 (Intersection 2)	**NB L**	**NB T**	**NB R**	**SB L**	**SB T**	**SB R**	**EB L**	**EB T**	**EB R**	**WB L**	**WB T**	**WB R**
AM Peak Hr Existing Tfc				7%		7%	7%	7%			7%	7%
PM Peak Hr Existing Tfc				7%		7%	7%	7%			7%	7%
POE Peak Hr Asmt (To ADOT Int'l POE)												
Adjacent Site Asmt - AM Opening				6%		6%	6%	6%			6%	6%
Adjacent Site Asmt - PM Opening				6%		6%	6%	6%			6%	6%
Adjacent Site Asmt - AM Horizon				6%		6%	6%	6%			6%	6%
Adjacent Site Asmt - PM Horizon				6%		6%	6%	6%			6%	6%

MV% Ratio: 30%

Heavy Vehicle % by Movement

James Ranch Rd & SR 80 (Intersection 1)	NB L	NB T	NB R	SB L	SB T	SB R	EB L	EB T	EB R	WB L	WB T	WB R
AM Peak Hr Existing Tfc	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
PM Peak Hr Existing Tfc	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
POE Peak Hr Asmt (To ADOT Int'l POE)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
POE Peak Hr Asmt (Remainder)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adjacent Site Asmt - AM Opening	14%	2%	14%	2%	2%	2%	2%	2%	14%	14%	2%	2%
Adjacent Site Asmt - PM Opening	14%	2%	14%	2%	2%	2%	2%	2%	14%	14%	2%	2%
Adjacent Site Asmt - AM Horizon	14%	2%	14%	2%	2%	2%	2%	2%	14%	14%	2%	2%
Adjacent Site Asmt - PM Horizon	14%	2%	14%	2%	2%	2%	2%	2%	14%	14%	2%	2%
US 191 & SR 80 (Intersection 2)	**NB L**	**NB T**	**NB R**	**SB L**	**SB T**	**SB R**	**EB L**	**EB T**	**EB R**	**WB L**	**WB T**	**WB R**
AM Peak Hr Existing Tfc	5%	5%	5%	4%	5%	4%	4%	4%	5%	5%	4%	4%
PM Peak Hr Existing Tfc	5%	5%	5%	4%	5%	4%	4%	4%	5%	5%	4%	4%
POE Peak Hr Asmt (To ADOT Int'l POE)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adjacent Site Asmt - AM Opening	2%	2%	2%	14%	2%	14%	14%	14%	2%	2%	14%	14%
Adjacent Site Asmt - PM Opening	2%	2%	2%	14%	2%	14%	14%	14%	2%	2%	14%	14%
Adjacent Site Asmt - AM Horizon	2%	2%	2%	14%	2%	14%	14%	14%	2%	2%	14%	14%
Adjacent Site Asmt - PM Horizon	2%	2%	2%	14%	2%	14%	14%	14%	2%	2%	14%	14%

ITE LU 150 Truck % Data:

11.2% = % of bidirectional truck traffic during truck peak @ 11AM-12PM
9.0% = % of bidirectional vehicle traffic during peak @ 3-4PM
7.3% = % of bidirectional vehicle traffic during truck peak @ 11AM-12PM
20% = ITE LU 150 truck % at one observed location (Trip Gen Handbook Appendix I)
35% = ITE TGM truck ADT rate vs all vehicles ADT rate
29% = ITE TGM truck AM Generator rate vs all vehicles AM Generator rate
26% = ITE TGM truck PM Generator rate vs all vehicles PM Generator rate
USE: 20%

Min Truck Percentage:
2% (per volume methodology email chain)

Additional Truck Data:

Node	Truck %	Notes
100870	13%	SR80 west of site (Near Double Adobe Rd)
100868	16%	SR80 - Lowell east of roundabout before meeting SR92
100867	7%	SR80 - Lowell north of roundabout after meeting SR92
100865	7%	SR80 west of Bisbee
100863	14%	SR80 south of Tombstone
100859	20%	SR80 in St David
100857	16%	SR80 north of St David
101743	14%	SR80 just before merging with I-10
		-> moderate to high truck % on SR80 west of site
102213	9%	US191 north of node 102213 (data we used)
102216	19%	US191 north of McNeal
102217	30%	US191 north of Elfrida
102219	17%	US191 west of Kansas Settlement Rd
102221	27%	US191 north of Dragoon Rd (last count before I-10)
		-> high truck % on US191
100879	11%	SR80 east of Washington Ave
		-> moderate truck % on SR80 east of site

__Instructions__

-Save each green tab as a separate "Text (Tab Delimited) file"
-Use the "Convert to CSV.xlsm" to convert the .txt files to necessary Synchro/Traffig .csv files (Use the "Convert Both" button)

	Analysis Year
Existing	2022
Opening	2028
Future	2050

Growth Rate

	SR80 Traffic	POE Traffic	US191 Traffic
Existing -> Opening	2.0%	1.1%	2.0%
(Growth Factor)	1.126	1.068	1.126
Existing -> Horizon	2.0%	1.1%	2.0%
(Growth Factor)	1.741	1.358	1.741

*No growth for warehousing site traffic

Low Vol Movement Adjustments:

Exst	1
Opening	5
Horizon	10

ASSUMED ALL ADJUSTMENTS = POVs

JAMES RANCH RD & SR 80 (INTERSECTION 1)

Passenger Cars	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	1	1	1	1	1	1	1	99	1	1	235	1
Existing PM	1	1	1	1	1	1	1	238	1	1	182	1
Opening AM	18	5	103	5	5	5	5	111	35	200	265	5
Opening PM	44	5	252	5	5	5	5	268	14	80	204	5
Horizon AM	60	10	343	10	10	10	10	172	117	666	409	10
Horizon PM	148	10	839	10	10	10	10	414	47	265	316	10
2028 No-Build AM	5	5	5	5	5	5	5	111	5	5	265	5
2028 No-Build PM	5	5	5	5	5	5	5	268	5	5	204	5
2050 No-Build AM	10	10	10	10	10	10	10	172	10	10	409	10
2050 No-Build PM	10	10	10	10	10	10	10	414	10	10	316	10

Medium Vehicles	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	0	0	0	0	7	0	0	16	0
Existing PM	0	0	0	0	0	0	0	16	0	0	12	0
Opening AM	1	0	8	0	0	0	0	8	3	15	18	0
Opening PM	3	0	19	0	0	0	0	18	1	6	14	0
Horizon AM	5	0	26	0	0	0	0	12	9	50	28	0
Horizon PM	11	0	63	0	0	0	0	28	4	20	21	0
2028 No-Build AM	0	0	0	0	0	0	0	8	0	0	18	0
2028 No-Build PM	0	0	0	0	0	0	0	18	0	0	14	0
2050 No-Build AM	0	0	0	0	0	0	0	12	0	0	28	0
2050 No-Build PM	0	0	0	0	0	0	0	28	0	0	21	0

Heavy Vehicles	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	0	0	0	0	6	0	0	13	0
Existing PM	0	0	0	0	0	0	0	13	0	0	10	0
Opening AM	3	0	51	0	0	0	0	6	21	53	30	0
Opening PM	8	0	77	0	0	0	0	15	17	32	26	0
Horizon AM	11	0	102	0	0	0	0	10	40	140	42	0
Horizon PM	26	0	189	0	0	0	0	23	27	70	37	0
2028 No-Build AM	0	0	0	0	0	0	0	6	0	0	15	0
2028 No-Build PM	0	0	0	0	0	0	0	15	0	0	11	0
2050 No-Build AM	0	0	0	0	0	0	0	10	0	0	23	0
2050 No-Build PM	0	0	0	0	0	0	0	23	0	0	18	0

TOTAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	1	1	1	1	1	1	1	111	1	1	264	1
Existing PM	1	1	1	1	1	1	1	267	1	1	204	1
Opening AM	23	5	162	5	5	5	5	125	59	268	312	5
Opening PM	56	5	348	5	5	5	5	301	32	118	245	5
Horizon AM	76	10	471	10	10	10	10	193	166	855	479	10
Horizon PM	185	10	1091	10	10	10	10	465	78	355	374	10
2028 No-Build AM	5	5	5	5	5	5	5	125	5	5	297	5
2028 No-Build PM	5	5	5	5	5	5	5	301	5	5	230	5
2050 No-Build AM	10	10	10	10	10	10	10	193	10	10	460	10
2050 No-Build PM	10	10	10	10	10	10	10	465	10	10	355	10

PC %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%
Existing PM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%
Opening AM	80%	98%	64%	98%	98%	98%	98%	89%	60%	75%	85%	98%
Opening PM	80%	98%	72%	98%	98%	98%	98%	89%	43%	68%	84%	98%
Horizon AM	80%	98%	73%	98%	98%	98%	98%	89%	71%	78%	85%	98%
Horizon PM	80%	98%	77%	98%	98%	98%	98%	89%	60%	75%	84%	98%
2028 No-Build AM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%
2028 No-Build PM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%
2050 No-Build AM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%
2050 No-Build PM	98%	98%	98%	98%	98%	98%	98%	89%	98%	98%	89%	98%

MV %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%
Existing PM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%
Opening AM	6%	0%	5%	0%	0%	0%	0%	6%	4%	6%	6%	0%
Opening PM	6%	0%	5%	0%	0%	0%	0%	6%	3%	5%	6%	0%
Horizon AM	6%	0%	5%	0%	0%	0%	0%	6%	5%	6%	6%	0%
Horizon PM	6%	0%	6%	0%	0%	0%	0%	6%	5%	6%	6%	0%
2028 No-Build AM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%
2028 No-Build PM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%
2050 No-Build AM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%
2050 No-Build PM	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	6%	0%

HV %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Existing PM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Opening AM	14%	2%	32%	2%	2%	2%	2%	5%	36%	20%	10%	2%
Opening PM	14%	2%	22%	2%	2%	2%	2%	5%	54%	27%	11%	2%
Horizon AM	14%	2%	22%	2%	2%	2%	2%	5%	24%	16%	9%	2%
Horizon PM	14%	2%	17%	2%	2%	2%	2%	5%	35%	20%	10%	2%
2028 No-Build AM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
2028 No-Build PM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
2050 No-Build AM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
2050 No-Build PM	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%

Truck %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
Existing PM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
Opening AM	20%	2%	36%	2%	2%	2%	2%	11%	40%	25%	15%	2%
Opening PM	20%	2%	28%	2%	2%	2%	2%	11%	57%	32%	16%	2%
Horizon AM	20%	2%	27%	2%	2%	2%	2%	11%	29%	22%	15%	2%
Horizon PM	20%	2%	23%	2%	2%	2%	2%	11%	40%	25%	16%	2%
2028 No-Build AM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
2028 No-Build PM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
2050 No-Build AM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%
2050 No-Build PM	2%	2%	2%	2%	2%	2%	2%	11%	2%	2%	11%	2%

Total * PC%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	18	5	103	5	5	5	5	111	35	200	265	5
Opening PM	44	5	252	5	5	5	5	268	14	80	204	5
Horizon AM	60	10	343	10	10	10	10	172	117	666	409	10
Horizon PM	148	10	839	10	10	10	10	414	47	265	316	10
2028 No-Build AM	5	5	5	5	5	5	5	111	5	5	265	5
2028 No-Build PM	5	5	5	5	5	5	5	268	5	5	204	5
2050 No-Build AM	10	10	10	10	10	10	10	172	10	10	409	10
2050 No-Build PM	10	10	10	10	10	10	10	414	10	10	316	10

PC Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		66%			98%			80%			80%	
Opening PM		74%			98%			85%			79%	
Horizon AM		74%			98%			81%			81%	
Horizon PM		78%			98%			85%			80%	
2028 No-Build AM		98%			98%			90%			89%	
2028 No-Build PM		98%			98%			89%			89%	
2050 No-Build AM		98%			98%			90%			89%	
2050 No-Build PM		98%			98%			89%			89%	

Total * MV%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	1	0	8	0	0	0	0	8	3	15	18	0
Opening PM	3	0	19	0	0	0	0	18	1	6	14	0
Horizon AM	5	0	26	0	0	0	0	12	9	50	28	0
Horizon PM	11	0	63	0	0	0	0	28	4	20	21	0
2028 No-Build AM	0	0	0	0	0	0	0	8	0	0	18	0
2028 No-Build PM	0	0	0	0	0	0	0	18	0	0	14	0
2050 No-Build AM	0	0	0	0	0	0	0	12	0	0	28	0
2050 No-Build PM	0	0	0	0	0	0	0	28	0	0	21	0

MV Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		5%			0%			5%			6%	
Opening PM		5%			0%			6%			5%	
Horizon AM		5%			0%			6%			6%	
Horizon PM		6%			0%			6%			6%	
2028 No-Build AM		0%			0%			6%			6%	
2028 No-Build PM		0%			0%			6%			6%	
2050 No-Build AM		0%			0%			5%			6%	
2050 No-Build PM		0%			0%			6%			6%	

Total * HV%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	3	0	51	0	0	0	0	6	21	53	30	0
Opening PM	8	0	77	0	0	0	0	15	17	32	26	0
Horizon AM	11	0	102	0	0	0	0	10	40	140	42	0
Horizon PM	26	0	189	0	0	0	0	23	27	70	37	0
2028 No-Build AM	0	0	0	0	0	0	0	6	0	0	15	0
2028 No-Build PM	0	0	0	0	0	0	0	15	0	0	11	0
2050 No-Build AM	0	0	0	0	0	0	0	10	0	0	23	0
2050 No-Build PM	0	0	0	0	0	0	0	23	0	0	18	0

HV Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		29%			2%			15%			14%	
Opening PM		21%			2%			10%			16%	
Horizon AM		20%			2%			13%			14%	
Horizon PM		17%			2%			9%			14%	
2028 No-Build AM		2%			2%			5%			5%	
2028 No-Build PM		2%			2%			5%			5%	
2050 No-Build AM		2%			2%			5%			5%	
2050 No-Build PM		2%			2%			5%			5%	

Check	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		100%			100%			100%			100%	
Opening PM		100%			100%			100%			100%	
Horizon AM		100%			100%			100%			100%	
Horizon PM		100%			100%			100%			100%	
2028 No-Build AM		100%			100%			100%			100%	
2028 No-Build PM		100%			100%			100%			100%	
2050 No-Build AM		100%			100%			100%			100%	
2050 No-Build PM		100%			100%			100%			100%	

US 191 & SR 80 (INTERSECTION 2)

Passenger Cars	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	66	0	40	28	71	0	0	182	121
Existing PM	0	0	0	75	0	45	68	170	0	0	140	94
Opening AM	47	34	4	30	45	75	47	105	62	6	328	103
Opening PM	48	35	4	7	78	63	114	298	107	10	178	70
Horizon AM	72	53	7	46	69	169	101	319	95	9	810	159
Horizon PM	74	54	7	11	121	119	244	843	166	15	395	109
2028 No-Build AM	0	0	0	75	0	45	32	79	0	0	205	137
2028 No-Build PM	0	0	0	85	0	51	76	191	0	0	158	105
2050 No-Build AM	0	0	0	116	0	69	49	123	0	0	317	211
2050 No-Build PM	0	0	0	131	0	79	118	296	0	0	245	163

Medium Vehicles	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	5	0	3	2	6	0	0	14	10
Existing PM	0	0	0	6	0	4	5	13	0	0	11	7
Opening AM	0	0	0	6	0	6	4	13	0	0	29	11
Opening PM	0	0	0	7	0	5	9	31	0	0	18	8
Horizon AM	0	0	0	9	0	13	8	32	0	0	67	17
Horizon PM	0	0	0	10	0	9	19	77	0	0	36	13
2028 No-Build AM	0	0	0	6	0	4	3	6	0	0	16	11
2028 No-Build PM	0	0	0	7	0	4	6	15	0	0	12	8
2050 No-Build AM	0	0	0	9	0	5	4	10	0	0	25	17
2050 No-Build PM	0	0	0	10	0	6	9	23	0	0	19	13

Heavy Vehicles	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	3	0	2	1	3	0	0	8	5
Existing PM	0	0	0	3	0	2	3	8	0	0	6	4
Opening AM	2	2	0	19	2	22	37	16	3	0	37	4
Opening PM	2	2	0	18	4	19	43	41	5	0	17	3
Horizon AM	4	3	0	25	3	40	53	52	5	0	110	7
Horizon PM	4	3	0	23	6	29	69	130	8	1	47	5
2028 No-Build AM	0	0	0	3	0	2	1	4	0	0	9	6
2028 No-Build PM	0	0	0	4	0	2	3	9	0	0	7	5
2050 No-Build AM	0	0	0	5	0	3	2	6	0	0	14	9
2050 No-Build PM	0	0	0	6	0	4	5	13	0	0	11	7

TOTAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	75	0	45	32	79	0	0	205	136
Existing PM	0	0	0	85	0	51	76	191	0	0	158	105
Opening AM	49	36	4	55	47	103	88	134	65	6	393	118
Opening PM	51	37	5	32	82	87	166	370	113	10	212	82
Horizon AM	76	55	7	80	73	222	162	402	100	9	987	182
Horizon PM	78	57	7	44	127	157	332	1050	174	16	478	126
2028 No-Build AM	0	0	0	84	0	50	36	89	0	0	230	154
2028 No-Build PM	0	0	0	95	0	57	86	215	0	0	178	118
2050 No-Build AM	0	0	0	130	0	78	55	138	0	0	356	237
2050 No-Build PM	0	0	0	147	0	88	133	332	0	0	275	183

PC %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%
Existing PM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%
Opening AM	95%	95%	95%	54%	95%	73%	54%	79%	95%	95%	83%	87%
Opening PM	95%	95%	95%	22%	95%	72%	69%	81%	95%	95%	84%	86%
Horizon AM	95%	95%	95%	58%	95%	76%	62%	79%	95%	95%	82%	87%
Horizon PM	95%	95%	95%	24%	95%	75%	73%	80%	95%	95%	83%	86%
2028 No-Build AM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%
2028 No-Build PM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%
2050 No-Build AM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%
2050 No-Build PM	100%	100%	100%	89%	100%	89%	89%	89%	100%	100%	89%	89%

MV %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%
Existing PM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%
Opening AM	0%	0%	0%	11%	0%	6%	4%	10%	0%	0%	7%	9%
Opening PM	0%	0%	0%	21%	0%	6%	5%	8%	0%	0%	8%	10%
Horizon AM	0%	0%	0%	11%	0%	6%	5%	8%	0%	0%	7%	9%
Horizon PM	0%	0%	0%	23%	0%	6%	6%	7%	0%	0%	8%	10%
2028 No-Build AM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%
2028 No-Build PM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%
2050 No-Build AM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%
2050 No-Build PM	0%	0%	0%	7%	0%	7%	7%	7%	0%	0%	7%	7%

HV %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%
Existing PM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%
Opening AM	5%	5%	5%	35%	5%	22%	42%	12%	5%	5%	9%	4%
Opening PM	5%	5%	5%	57%	5%	22%	26%	11%	5%	5%	8%	4%
Horizon AM	5%	5%	5%	31%	5%	18%	33%	13%	5%	5%	11%	4%
Horizon PM	5%	5%	5%	52%	5%	19%	21%	12%	5%	5%	10%	4%
2028 No-Build AM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%
2028 No-Build PM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%
2050 No-Build AM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%
2050 No-Build PM	0%	0%	0%	4%	0%	4%	4%	4%	0%	0%	4%	4%

Truck %	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%
Existing PM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%
Opening AM	5%	5%	5%	46%	5%	27%	46%	21%	5%	5%	17%	13%
Opening PM	5%	5%	5%	78%	5%	28%	31%	19%	5%	5%	16%	14%
Horizon AM	5%	5%	5%	42%	5%	24%	38%	21%	5%	5%	18%	13%
Horizon PM	5%	5%	5%	76%	5%	25%	27%	20%	5%	5%	17%	14%
2028 No-Build AM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%
2028 No-Build PM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%
2050 No-Build AM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%
2050 No-Build PM	0%	0%	0%	11%	0%	11%	11%	11%	0%	0%	11%	11%

Total * PC%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	47	34	4	30	45	75	47	105	62	6	328	103
Opening PM	48	35	4	7	78	63	114	298	107	10	178	70
Horizon AM	72	53	7	46	69	169	101	319	95	9	810	159
Horizon PM	74	54	7	11	121	119	244	843	166	15	395	109
2028 No-Build AM	0	0	0	75	0	45	32	79	0	0	205	137
2028 No-Build PM	0	0	0	85	0	51	76	191	0	0	158	105
2050 No-Build AM	0	0	0	116	0	69	49	123	0	0	317	211
2050 No-Build PM	0	0	0	131	0	79	118	296	0	0	245	163

PC Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		95%			73%			75%			84%	
Opening PM		95%			74%			80%			85%	
Horizon AM		95%			76%			78%			83%	
Horizon PM		95%			76%			81%			84%	
2028 No-Build AM		0%			89%			89%			89%	
2028 No-Build PM		0%			89%			89%			89%	
2050 No-Build AM		0%			89%			89%			89%	
2050 No-Build PM		0%			89%			89%			89%	

Total * MV%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	0	0	0	6	0	6	4	13	0	0	29	11
Opening PM	0	0	0	7	0	5	9	31	0	0	18	8
Horizon AM	0	0	0	9	0	13	8	32	0	0	67	17
Horizon PM	0	0	0	10	0	9	19	77	0	0	36	13
2028 No-Build AM	0	0	0	6	0	4	3	6	0	0	16	11
2028 No-Build PM	0	0	0	7	0	4	6	15	0	0	12	8
2050 No-Build AM	0	0	0	9	0	5	4	10	0	0	25	17
2050 No-Build PM	0	0	0	10	0	6	9	23	0	0	19	13

MV Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		0%			6%			6%			8%	
Opening PM		0%			6%			6%			8%	
Horizon AM		0%			6%			6%			7%	
Horizon PM		0%			6%			6%			8%	
2028 No-Build AM		0%			7%			7%			7%	
2028 No-Build PM		0%			7%			7%			7%	
2050 No-Build AM		0%			7%			7%			7%	
2050 No-Build PM		0%			7%			7%			7%	

Total * HV%	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM	2	2	0	19	2	22	37	16	3	0	37	4
Opening PM	2	2	0	18	4	19	43	41	5	0	17	3
Horizon AM	4	3	0	25	3	40	53	52	5	0	110	7
Horizon PM	4	3	0	23	6	29	69	130	8	1	47	5
2028 No-Build AM	0	0	0	3	0	2	1	4	0	0	9	6
2028 No-Build PM	0	0	0	4	0	2	3	9	0	0	7	5
2050 No-Build AM	0	0	0	5	0	3	2	6	0	0	14	9
2050 No-Build PM	0	0	0	6	0	4	5	13	0	0	11	7

HV Weighted Avg	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		5%			21%			20%			8%	
Opening PM		5%			21%			14%			7%	
Horizon AM		5%			18%			17%			10%	
Horizon PM		5%			18%			13%			8%	
2028 No-Build AM		0%			4%			4%			4%	
2028 No-Build PM		0%			4%			4%			4%	
2050 No-Build AM		0%			4%			4%			4%	
2050 No-Build PM		0%			4%			4%			4%	

Check	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Opening AM		100%			100%			100%			100%	
Opening PM		100%			100%			100%			100%	
Horizon AM		100%			100%			100%			100%	
Horizon PM		100%			100%			100%			100%	
2028 No-Build AM		0%			100%			100%			100%	
2028 No-Build PM		0%			100%			100%			100%	
2050 No-Build AM		0%			100%			100%			100%	
2050 No-Build PM		0%			100%			100%			100%	

JAMES RANCH RD & SR 80 (INTERSECTION 1)

Total Volumes by Movement

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	1	1	1	1	1	1	1	111	1	1	264	1
Existing PM	1	1	1	1	1	1	1	267	1	1	204	1
Opening AM	23	5	162	5	5	5	5	125	59	268	312	5
Opening PM	56	5	348	5	5	5	5	301	32	118	245	5
Horizon AM	76	10	471	10	10	10	10	193	166	855	479	10
Horizon PM	185	10	1091	10	10	10	10	465	78	355	374	10
2028 No-Build AM	5	5	5	5	5	5	5	125	5	5	297	5
2028 No-Build PM	5	5	5	5	5	5	5	301	5	5	230	5
2050 No-Build AM	10	10	10	10	10	10	10	193	10	10	460	10
2050 No-Build PM	10	10	10	10	10	10	10	465	10	10	355	10

Total Volumes by Approach

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	3	3	6	3	3	6	113	266	379	266	113	379
Existing PM	3	3	6	3	3	6	269	206	475	206	269	475
Opening AM	189	332	521	15	15	30	189	340	529	585	292	877
Opening PM	408	155	563	15	15	30	338	305	643	367	653	1021
Horizon AM	556	1031	1587	30	30	60	369	564	933	1344	674	2018
Horizon PM	1286	442	1728	30	30	60	552	569	1122	739	1566	2305
2028 No-Build AM	15	15	30	15	15	30	135	307	442	307	135	442
2028 No-Build PM	15	15	30	15	15	30	311	240	550	240	311	550
2050 No-Build AM	30	30	60	30	30	60	213	480	693	480	213	693
2050 No-Build PM	30	30	60	30	30	60	485	375	860	375	485	860

K-Factor

	SOUTH LEG	NORTH LEG	WEST LEG	EAST LEG
AM	0.09	0.09	0.066	0.066
PM	0.09	0.09	0.083	0.083

Estimated ADT (Raw)

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	33	33	67	33	33	67	1708	4020	5727	4020	1708	5727
Existing PM	33	33	67	33	33	67	3237	2479	5715	2479	3237	5715
Opening AM	2103	3687	5790	167	167	333	2856	5136	7993	8841	4407	13248
Opening PM	4537	1723	6260	167	167	333	4069	3672	7741	4419	7862	12281
Horizon AM	6179	11457	17636	333	333	667	5578	8526	14104	20308	10182	30490
Horizon PM	14290	4912	19202	333	333	667	6646	6849	13495	8888	18840	27728
2028 No-Build AM	167	167	333	167	167	333	2040	4644	6684	4644	2040	6684
2028 No-Build PM	167	167	333	167	167	333	3738	2884	6623	2884	3738	6623
2050 No-Build AM	333	333	667	333	333	667	3223	7248	10471	7248	3223	10471
2050 No-Build PM	333	333	667	333	333	667	5834	4514	10348	4514	5834	10348

Estimated ADT (Rounded)

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	0	0	100	0	0	100	1700	4000	5700	4000	1700	5700
Existing PM	0	0	100	0	0	100	3200	2500	5700	2500	3200	5700
Opening AM	2100	3700	5800	200	200	300	2900	5100	8000	8800	4400	13200
Opening PM	4500	1700	6300	200	200	300	4100	3700	7700	4400	7900	12300
Horizon AM	6200	11500	17600	300	300	700	5600	8500	14100	20300	10200	30500
Horizon PM	14300	4900	19200	300	300	700	6600	6800	13500	8900	18800	27700
2028 No-Build AM	200	200	300	200	200	300	2000	4600	6700	4600	2000	6700
2028 No-Build PM	200	200	300	200	200	300	3700	2900	6600	2900	3700	6600
2050 No-Build AM	300	300	700	300	300	700	3200	7200	10500	7200	3200	10500
2050 No-Build PM	300	300	700	300	300	700	5800	4500	10300	4500	5800	10300

Round to nearest: 100

Green =max ADT value of the AM/PM estimates

Calculated D-Factors

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB		SB	NB		EB	WB		WB	EB	
Opening	55%	45%		50%	50%		44%	56%		52%	48%	
Horizon	56%	44%		50%	50%		44%	56%		50%	50%	
Average	55%	45%	100%	50%	50%	100%	44%	56%	100%	51%	49%	100%

US 191 & SR 80 (INTERSECTION 2)

Total Volumes by Movement

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Existing AM	0	0	0	75	0	45	32	79	0	0	205	136
Existing PM	0	0	0	85	0	51	76	191	0	0	158	105
Opening AM	49	36	4	55	47	103	88	134	65	6	393	118
Opening PM	51	37	5	32	82	87	166	370	113	10	212	82
Horizon AM	76	55	7	80	73	222	162	402	100	9	987	182
Horizon PM	78	57	7	44	127	157	332	1050	174	16	478	126
2028 No-Build AM	0	0	0	84	0	50	36	89	0	0	230	154
2028 No-Build PM	0	0	0	95	0	57	86	215	0	0	178	118
2050 No-Build AM	0	0	0	130	0	78	55	138	0	0	356	237
2050 No-Build PM	0	0	0	147	0	88	133	332	0	0	275	183

Total Volumes by Approach

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	0	0	0	120	168	288	111	249	360	341	154	495
Existing PM	0	0	0	136	181	317	267	209	476	263	275	538
Opening AM	89	118	207	205	242	447	287	545	832	517	194	711
Opening PM	92	205	297	201	285	485	648	349	998	304	406	710
Horizon AM	138	182	320	375	399	774	664	1285	1949	1179	489	1668
Horizon PM	142	316	459	328	515	843	1556	714	2270	620	1101	1721
2028 No-Build AM	0	0	0	135	189	324	125	281	406	384	173	557
2028 No-Build PM	0	0	0	153	204	357	301	235	536	296	310	606
2050 No-Build AM	0	0	0	208	293	501	193	434	627	594	268	862
2050 No-Build PM	0	0	0	236	316	552	465	363	828	458	479	937

K-Factor

	SOUTH LEG	NORTH LEG	WEST LEG	EAST LEG
AM K Factor:	0.059	0.065	0.066	0.060
PM K Factor:	0.084	0.074	0.083	0.074

Estimated ADT (Raw)

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	0	0	0	1841	2589	4430	1677	3769	5447	5720	2583	8303
Existing PM	0	0	0	1841	2465	4306	3213	2510	5722	3574	3742	7316
Opening AM	1520	1999	3519	3159	3723	6882	4332	8242	12574	8674	3247	11921
Opening PM	1091	2428	3519	2725	3867	6592	7802	4202	12005	4126	5516	9642
Horizon AM	2350	3090	5440	5775	6146	11922	10031	19424	29455	19773	8211	27983
Horizon PM	1686	3754	5440	4452	7001	11453	18720	8587	27306	8431	14956	23387
2028 No-Build AM	0	0	0	2073	2916	4989	1889	4245	6134	6442	2909	9351
2028 No-Build PM	0	0	0	2073	2776	4849	3618	2827	6444	4025	4214	8239
2050 No-Build AM	0	0	0	3204	4508	7712	2920	6562	9483	9959	4497	14456
2050 No-Build PM	0	0	0	3204	4292	7496	5593	4370	9963	6222	6515	12737

Estimated ADT (Rounded)

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB	TOTAL	SB	NB	TOTAL	EB	WB	TOTAL	WB	EB	TOTAL
Existing AM	0	0	0	1800	2600	4400	1700	3800	5400	5700	2600	8300
Existing PM	0	0	0	1800	2500	4300	3200	2500	5700	3600	3700	7300
Opening AM	1500	2000	3500	3200	3700	6900	4300	8200	12600	8700	3200	11900
Opening PM	1100	2400	3500	2700	3900	6600	7800	4200	12000	4100	5500	9600
Horizon AM	2300	3100	5400	5800	6100	11900	10000	19400	29500	19800	8200	28000
Horizon PM	1700	3800	5400	4500	7000	11500	18700	8600	27300	8400	15000	23400
2028 No-Build AM	0	0	0	2100	2900	5000	1900	4200	6100	6400	2900	9400
2028 No-Build PM	0	0	0	2100	2800	4800	3600	2800	6400	4000	4200	8200
2050 No-Build AM	0	0	0	3200	4500	7700	2900	6600	9500	10000	4500	14500
2050 No-Build PM	0	0	0	3200	4300	7500	5600	4400	10000	6200	6500	12700

Calculated D-Factors

	SOUTH LEG			NORTH LEG			WEST LEG			EAST LEG		
	NB	SB		SB	NB		EB	WB		WB	EB	
Opening	37%	63%		44%	56%		49%	51%		59%	41%	
Horizon	37%	63%		44%	56%		51%	49%		55%	45%	
Average	37%	63%	100%	44%	56%	100%	50%	50%	100%	57%	43%	100%

Appendix 5. Relevant Standards

b. The specific assumptions and data sources used in deriving trip distribution and assignment shall be documented in the report.

(8) Capacity Analysis

a. Level of service shall be computed for all signalized and unsignalized intersections within the study area in accordance with the latest edition of the Highway Capacity Manual or with any software that uses HCS methodology. The level of service shall be calculated and reported by intersection, intersection approach, and lane group within the approach.

b. For signalized intersections, operational analyses shall be performed for time horizons up to five years. The planning method will be acceptable for time horizons beyond five years. Analyses may include modifications to the existing signal timing if the study area is within a coordinated signal system; Highway Capacity Manual signal timing methods should not be used for generating signal timing.

c. Analyses may include an arterial analysis in accordance with the latest edition of the Highway Capacity Manual.

d. Peak hour factors used for future conditions shall not exceed 0.90. The following peak hour factors shall be used unless otherwise directed by the Regional Traffic Engineer:

PHF = 0.80 for < 75 vph per lane
PHF = 0.85 for 75 - 300 vph per lane
PHF = 0.90 for > 300 vph per lane

(9) Traffic Signal Needs Study

a. A Traffic Signal Needs Study shall be conducted for all new proposed signals for the base year. If the warrants are not met for the base year, they should be evaluated for each year in the study horizon.

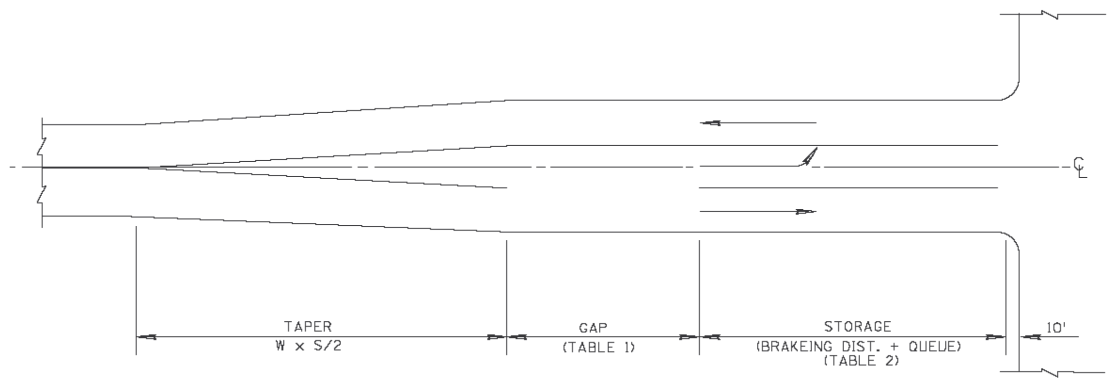
b. A Traffic Signal Needs Study shall be conducted in accordance with ADOT Traffic Guidelines and Processes 611.

c. Existing traffic signals adjacent to the development's access to the State highway shall be evaluated for continued signal warrants, phasing, timing, and coordination for each year in the study horizon, in accordance with Table 240-1.

(10) Crash Analysis

An analysis of three years of traffic crash data and crash prediction per HSM (if required); calculations shall be conducted to determine if the level of safety will deteriorate due to the addition of site traffic.

Figure 430-B. Left Turn Lane - Symmetrical Widening



Example: *W = 12'* *Gap = 140'* *Storage = 415' * + 50' = 465'*

S = 65 mph *(From Table 430-1)*

T = 12 x 65 / 2 = 390' ** From Table 430-2*

low ADT, minimum trucks

Total Length = 390' + 140' + 465' = 995'

Gap Length

Table 430-1 provides the length of the gap for left turn lanes. See Standard Drawing 4-M-1.03 for the turn lane standard.

Table 430-1. Left Turn Lane Gap Lengths

POSTED or DESIGN SPEED (mph)	GAP (feet)
< 40	60
40 - 50	90
> 50	140

Storage Length

The storage length is a combination of the braking distance (Table 430-2) and a queue length dependent on the anticipated traffic control for the intersection and the traffic demand at the turn.

storage length = braking distance + queue length

Table 430-2. Braking Distance

POSTED or DESIGN SPEED (mph)	DESIRABLE		MINIMUM		
	BRAKING SPEED (mph)	BRAKING DISTANCE (feet)	ENTERING SPEED (mph)	BRAKING SPEED (mph)	BRAKING DISTANCE (feet)
30	29	80	20	20	20
35	34	115	25	25	40
40	38	150	30	29	50
45	43	200	35	34	85
50	47	245	40	38	120
55	52	300	45	42	145
60	56	360	50	47	200
65	60	415	55	52	265
70	64	490	60	56	315
75	70	585	65	61	400

The “Desirable” braking distance shown in Table 430-2 is based on the assumption that a vehicle will have lost a few miles per hour through retardation by the vehicle’s engine and drive train prior to braking and that braking will actually begin when the vehicle is fully into the turn lane. The “Minimum” braking distance shown is based on the assumption of: (a) a drop of 10 mph in the average speed of a vehicle by the time it begins to enter the opening or “gap” of the turn lane; (b) there will be a further reduction in speed through engine retardation while entering the turn lane; and (c) assumed braking will begin once the vehicle is 2/3 of the way into the turn lane (see Figure 430-C).

directions); and six combinations of the *K*-factor and *D*-factor. To use this table, analysts must select a combination of *K* and *D* appropriate for their locality.

The 30-mi/h values further assume an average traffic signal spacing of 1,050 ft and 20 access points/mi, while the 45-mi/h values assume an average traffic signal spacing of 1,500 ft and 10 access points/mi.

Exhibit 16-16
Generalized Daily Service Volumes for Urban Street Facilities

K-Factor	*D*-Factor	Daily Service Volume by Lanes, LOS, and Speed (1,000 veh/day)											
		Two-Lane Streets				Four-Lane Streets				Six-Lane Streets			
		LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E	LOS B	LOS C	LOS D	LOS E
Posted Speed = 30 mi/h													
0.09	0.55	NA	1.7	11.8	17.8	NA	2.2	24.7	35.8	NA	2.6	38.7	54.0
	0.60	NA	1.6	10.8	16.4	NA	2.0	22.7	32.8	NA	2.4	35.6	49.5
0.10	0.55	NA	1.6	10.7	16.1	NA	2.0	22.3	32.2	NA	2.4	34.9	48.6
	0.60	NA	1.4	9.8	14.7	NA	1.8	20.4	29.5	NA	2.2	32.0	44.5
0.11	0.55	NA	1.4	9.7	14.6	NA	1.8	20.3	29.3	NA	2.1	31.7	44.1
	0.60	NA	1.3	8.9	13.4	NA	1.7	18.6	26.9	NA	2.0	29.1	40.5
Posted Speed = 45 mi/h													
0.09	0.55	NA	7.7	15.9	18.3	NA	16.5	33.6	36.8	NA	25.4	51.7	55.3
	0.60	NA	7.1	14.5	16.8	NA	15.1	30.8	33.7	NA	23.4	47.4	50.7
0.10	0.55	NA	7.0	14.3	16.5	NA	14.9	30.2	33.1	NA	23.0	46.5	49.7
	0.60	NA	6.4	13.1	15.1	NA	13.6	27.7	30.3	NA	21.0	42.7	45.6
0.11	0.55	NA	6.3	13.0	15.0	NA	13.5	27.5	30.1	NA	20.9	42.3	45.2
	0.60	NA	5.8	11.9	13.8	NA	12.4	25.2	27.6	NA	19.1	38.8	41.5

Notes: NA = not applicable; LOS cannot be achieved with the stated assumptions.
General assumptions include no roundabouts or all-way STOP-controlled intersections along the facility; coordinated, semiactuated traffic signals; Arrival Type 4; 120-s cycle time; protected left-turn phases; 0.45 weighted average *g/C* ratio; exclusive left-turn lanes with adequate queue storage provided at traffic signals; no exclusive right-turn lanes provided; no restrictive median; 2-mi facility length; 10% of traffic turns left and 10% turns right at each traffic signal; peak hour factor = 0.92; and base saturation flow rate = 1,900 pc/h/ln.
Additional assumptions for 30-mi/h facilities: signal spacing = 1,050 ft and 20 access points/mi.
Additional assumptions for 45-mi/h facilities: signal spacing = 1,500 ft and 10 access points/mi.

Exhibit 16-16 is provided for general planning use and should *not* be used to analyze any specific urban street facility or to make final decisions on important design features. A full operational analysis using this chapter's methodology is required for such specific applications.

The exhibit is useful in evaluating the overall performance of a large number of urban streets within a jurisdiction, as a first pass to determine where problems might exist or arise, or in determining where improvements might be needed. However, any urban street identified as likely to experience problems or need improvement should be subjected to a full operational analysis before any decisions on implementing specific improvements are made.

Daily service volumes are strongly affected by the *K*- and *D*-factors chosen as typical for the analysis. The values used for the facilities under study should be reasonable. Also, if any characteristic is significantly different from the typical values used to develop Exhibit 16-16, particularly the weighted average *g/C* ratio and traffic signal spacing, the values taken from this exhibit will not be representative of the study facilities. In such cases, analysts are advised to develop their own generalized service volume tables by using representative local values or to proceed to a full operational analysis.

Appendix 6. Existing Signal Timings

Intersection: **SR80 @ US191 (WEST)** MP: **364** Location: **Douglas**

MU #: 0050Q Warrant: UPDATE TIMING Timing As Of: **8/27/2010**

	PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8
Mvmnt	--	E/W	--	SB	--	--	--	--
Min Green	--	10	--	6	--	--	--	--
Veh Ext	--	6.0	--	1.5	--	--	--	--
Max I	--	60	--	25	--	--	--	--
Max 2	--	--	--	--	--	--	--	--
Max 3	--	--	--	--	--	--	--	--
Walk	--	--	--	--	--	--	--	--
Ped Clr	--	--	--	--	--	--	--	--
Max Init	--	40	--	--	--	--	--	--
Sec Act	--	2.0	--	--	--	--	--	--
TBR	--	--	--	--	--	--	--	--
TTR	--	--	--	--	--	--	--	--
Min Gap	--	--	--	--	--	--	--	--
Guar Pass	--	ON	--	--	--	--	--	--
Yellow	--	5.0	--	4.3	--	--	--	--
Red Clr	--	1.1	--	2.2	--	--	--	--
CNA	--	--	--	--	--	--	--	--
Det Memory	--	ON	--	--	--	--	--	--
Dual Entry	--	--	--	--	--	--	--	--
Recall Mode	--	MinV	--	--	--	--	--	--
Ext Start	--	YEL	--	--	--	--	--	--

TIME OF DAY FUNCTIONS

PGM	Funct'n	On	Off	Skip Days

VEHICLE DETECTOR DELAY/EXTEND TIMING

Phase(s)	Ctrl/Amp	Type	Sec
4 (RT)	Video	DELAY	8
4 (LT)	Video	DELAY	8

OVERLAPS TIMING OPTIONAL

O/L(Phases)	Grn	Yel	Red
(A)	--	--	--
(B)	--	--	--
(C)	--	--	--
(D)	--	--	--

PHASE SEQ: R1) 2,4

PROTECTED LEFT TURN PHASES:

PROT-PRM LEFT TURN PHASES:

RAILROAD PRE-EMPTION: ☐ VIDEO: ☑

EMERGENCY VEHICLE PRE-EMPTION: ☐ LOOPS: ☑

COORDINATION: ☐

Intersection: **SR80 @ US191 (WEST)** MP: **364** Location: **Douglas**

MU #: 0050Q Warrant: NEW SIGNAL Timing As Of: **5/21/2008**

	PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8
Mvmnt	--	E/W	--	SB	--	--	--	--
Min Green	--	30	--	6	--	--	--	--
Veh Ext	--	6.0	--	1.5	--	--	--	--
Max I	--	40	--	20	--	--	--	--
Max 2	--	--	--	--	--	--	--	--
Max 3	--	--	--	--	--	--	--	--
Walk	--	--	--	--	--	--	--	--
Ped Clr	--	--	--	--	--	--	--	--
Max Init	--	40	--	--	--	--	--	--
Sec Act	--	2.0	--	--	--	--	--	--
TBR	--	--	--	--	--	--	--	--
TTR	--	--	--	--	--	--	--	--
Min Gap	--	--	--	--	--	--	--	--
Guar Pass	--	ON	--	--	--	--	--	--
Yellow	--	5.0	--	4.3	--	--	--	--
Red Clr	--	1.1	--	2.2	--	--	--	--
CNA	--	--	--	--	--	--	--	--
Det Memory	--	ON	--	--	--	--	--	--
Dual Entry	--	--	--	--	--	--	--	--
Recall Mode	--	MinV	--	--	--	--	--	--
Ext Start	--	YEL	--	--	--	--	--	--

TIME OF DAY FUNCTIONS

PGM	Funct'n	On	Off	Skip Days

VEHICLE DETECTOR DELAY/EXTEND TIMING

Phase(s)	Ctrl/Amp	Type	Sec
4 (RT)	Video	DELAY	8
4 (LT)	Video	DELAY	3

OVERLAPS TIMING OPTIONAL

O/L(Phases)		Grn	Yel	Red
	--	--	--	
	--	--	--	
	--	--	--	
	--	--	--	

PHASE SEQ: R1) 2,4

PROTECTED LEFT TURN PHASES:

PROT-PRM LEFT TURN PHASES:

RAILROAD PRE-EMPTION: ☐ VIDEO: ☑

EMERGENCY VEHICLE PRE-EMPTION: ☐ LOOPS: ☑

COORDINATION: ☐

Appendix 7. Synchro and Rodel Output Reports

(Existing, 2028/2050 No-Build, 2028/2050 Build, Grade Separation Sensitivity Analysis)

Intersection												
Int Delay, s/veh	0.3											
Movement	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**
Lane Configurations												
Traffic Vol, veh/h	1	111	1	1	264	1	1	1	1	1	1	1
Future Vol, veh/h	1	111	1	1	264	1	1	1	1	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	75	75	75	87	87	87	50	50	50	50	50	50
Heavy Vehicles, %	2	11	2	2	11	2	2	2	2	2	2	2
Mvmt Flow	1	148	1	1	303	1	2	2	2	2	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	304	0	0	149	0	0	306	457	75	383	457	152
Stage 1	-	-	-	-	-	-	151	151	-	306	306	-
Stage 2	-	-	-	-	-	-	155	306	-	77	151	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1254	-	-	1430	-	-	623	498	971	550	498	867
Stage 1	-	-	-	-	-	-	836	771	-	679	660	-
Stage 2	-	-	-	-	-	-	832	660	-	923	771	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1254	-	-	1430	-	-	619	497	971	547	497	867
Mov Cap-2 Maneuver	-	-	-	-	-	-	619	497	-	547	497	-
Stage 1	-	-	-	-	-	-	835	770	-	678	659	-
Stage 2	-	-	-	-	-	-	827	659	-	918	770	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0	10.6	11.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	644	1254	-	-	1430	-	-	601
HCM Lane V/C Ratio	0.009	0.001	-	-	0.001	-	-	0.01
HCM Control Delay (s)	10.6	7.9	-	-	7.5	-	-	11.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	267	1	1	204	1	1	1	1	1	1	1
Future Vol, veh/h	1	267	1	1	204	1	1	1	1	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	85	85	85	50	50	50	50	50	50
Heavy Vehicles, %	2	11	2	2	11	2	2	2	2	2	2	2
Mvmt Flow	1	287	1	1	240	1	2	2	2	2	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	241	0	0	288	0	0	413	533	144	390	533	121
Stage 1	-	-	-	-	-	-	290	290	-	243	243	-
Stage 2	-	-	-	-	-	-	123	243	-	147	290	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1323	-	-	1271	-	-	523	451	877	543	451	908
Stage 1	-	-	-	-	-	-	694	671	-	739	703	-
Stage 2	-	-	-	-	-	-	868	703	-	841	671	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1323	-	-	1271	-	-	519	450	877	539	450	908
Mov Cap-2 Maneuver	-	-	-	-	-	-	519	450	-	539	450	-
Stage 1	-	-	-	-	-	-	693	670	-	738	702	-
Stage 2	-	-	-	-	-	-	863	702	-	836	670	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	11.4	11.3
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	567	1323	-	-	1271	-	-	579
HCM Lane V/C Ratio	0.011	0.001	-	-	0.001	-	-	0.01
HCM Control Delay (s)	11.4	7.7	-	-	7.8	-	-	11.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	125	5	5	297	5	5	5	5	5	5	5
Future Vol, veh/h	5	125	5	5	297	5	5	5	5	5	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	85	85	80	80	80	80	80	80
Heavy Vehicles, %	2	11	47	25	15	2	20	2	36	2	2	2
Mvmt Flow	6	156	6	6	349	6	6	6	6	6	6	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	355	0	0	162	0	0	361	538	81	457	538	178
Stage 1	-	-	-	-	-	-	171	171	-	364	364	-
Stage 2	-	-	-	-	-	-	190	367	-	93	174	-
Critical Hdwy	4.14	-	-	4.6	-	-	7.9	6.54	7.62	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.45	-	-	3.7	4.02	3.66	3.52	4.02	3.32
Pot Cap-1 Maneuver	1200	-	-	1262	-	-	527	448	863	487	448	834
Stage 1	-	-	-	-	-	-	764	756	-	627	622	-
Stage 2	-	-	-	-	-	-	744	621	-	904	754	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1200	-	-	1262	-	-	514	444	863	475	444	834
Mov Cap-2 Maneuver	-	-	-	-	-	-	514	444	-	475	444	-
Stage 1	-	-	-	-	-	-	760	752	-	624	619	-
Stage 2	-	-	-	-	-	-	727	618	-	886	750	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.1	11.7	11.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	560	1200	-	-	1262	-	-	540
HCM Lane V/C Ratio	0.033	0.005	-	-	0.005	-	-	0.035
HCM Control Delay (s)	11.7	8	-	-	7.9	-	-	11.9
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	301	5	5	230	5	5	5	5	5	5	5
Future Vol, veh/h	5	301	5	5	230	5	5	5	5	5	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	80	85	85	80	80	80	80	80	80
Heavy Vehicles, %	2	11	65	32	16	2	20	2	27	2	2	2
Mvmt Flow	6	354	6	6	271	6	6	6	6	6	6	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	277	0	0	360	0	0	520	658	180	478	658	139
Stage 1	-	-	-	-	-	-	369	369	-	286	286	-
Stage 2	-	-	-	-	-	-	151	289	-	192	372	-
Critical Hdwy	4.14	-	-	4.74	-	-	7.9	6.54	7.44	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.52	-	-	3.7	4.02	3.57	3.52	4.02	3.32
Pot Cap-1 Maneuver	1283	-	-	1006	-	-	401	383	759	470	383	884
Stage 1	-	-	-	-	-	-	576	619	-	697	674	-
Stage 2	-	-	-	-	-	-	786	672	-	791	617	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1283	-	-	1006	-	-	390	379	759	456	379	884
Mov Cap-2 Maneuver	-	-	-	-	-	-	390	379	-	456	379	-
Stage 1	-	-	-	-	-	-	573	616	-	694	670	-
Stage 2	-	-	-	-	-	-	769	668	-	773	614	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	13.2	12.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	460	1283	-	-	1006	-	-	503
HCM Lane V/C Ratio	0.041	0.005	-	-	0.006	-	-	0.037
HCM Control Delay (s)	13.2	7.8	-	-	8.6	-	-	12.4
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	193	10	10	460	10	10	10	10	10	10	10
Future Vol, veh/h	10	193	10	10	460	10	10	10	10	10	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	80	85	85	80	80	80	80	80	80
Heavy Vehicles, %	2	11	33	22	15	2	20	2	27	2	2	2
Mvmt Flow	13	227	12	13	541	12	13	13	13	13	13	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	553	0	0	239	0	0	562	838	120	719	838	277
Stage 1	-	-	-	-	-	-	259	259	-	573	573	-
Stage 2	-	-	-	-	-	-	303	579	-	146	265	-
Critical Hdwy	4.14	-	-	4.54	-	-	7.9	6.54	7.44	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.42	-	-	3.7	4.02	3.57	3.52	4.02	3.32
Pot Cap-1 Maneuver	1013	-	-	1191	-	-	373	301	835	316	301	720
Stage 1	-	-	-	-	-	-	675	692	-	472	502	-
Stage 2	-	-	-	-	-	-	634	499	-	842	688	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1013	-	-	1191	-	-	348	294	835	296	294	720
Mov Cap-2 Maneuver	-	-	-	-	-	-	348	294	-	296	294	-
Stage 1	-	-	-	-	-	-	666	683	-	466	496	-
Stage 2	-	-	-	-	-	-	601	494	-	804	679	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.2	14.9	15.9
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	401	1013	-	-	1191	-	-	367
HCM Lane V/C Ratio	0.094	0.012	-	-	0.01	-	-	0.102
HCM Control Delay (s)	14.9	8.6	-	-	8.1	-	-	15.9
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	465	10	10	355	10	10	10	10	10	10	10
Future Vol, veh/h	10	465	10	10	355	10	10	10	10	10	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	105	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	80	85	85	80	80	80	80	80	80
Heavy Vehicles, %	2	11	46	25	16	2	20	2	23	2	2	2
Mvmt Flow	13	547	12	13	418	12	13	13	13	13	13	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	430	0	0	559	0	0	821	1035	280	756	1035	215
Stage 1	-	-	-	-	-	-	579	579	-	450	450	-
Stage 2	-	-	-	-	-	-	242	456	-	306	585	-
Critical Hdwy	4.14	-	-	4.6	-	-	7.9	6.54	7.36	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.45	-	-	3.7	4.02	3.53	3.52	4.02	3.32
Pot Cap-1 Maneuver	1126	-	-	865	-	-	238	230	658	297	230	790
Stage 1	-	-	-	-	-	-	426	499	-	558	570	-
Stage 2	-	-	-	-	-	-	691	567	-	679	496	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1126	-	-	865	-	-	220	224	658	273	224	790
Mov Cap-2 Maneuver	-	-	-	-	-	-	220	224	-	273	224	-
Stage 1	-	-	-	-	-	-	421	493	-	551	561	-
Stage 2	-	-	-	-	-	-	655	558	-	642	490	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	19.5	17.8
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	285	1126	-	-	865	-	-	319
HCM Lane V/C Ratio	0.132	0.011	-	-	0.014	-	-	0.118
HCM Control Delay (s)	19.5	8.2	-	-	9.2	-	-	17.8
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.4

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	125	59	268	312	5	23	5	162	5	5	5
Future Vol, veh/h	5	125	59	268	312	5	23	5	162	5	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	150	105	-	-	150	-	0	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	85	85	85	80	80	85	80	80	80
Heavy Vehicles, %	2	11	47	25	15	2	20	2	36	2	2	2
Mvmt Flow	6	147	69	315	367	6	29	6	191	6	6	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	373	0	0	216	0	0	976	1162	74	1089	1228	187
Stage 1	-	-	-	-	-	-	159	159	-	1000	1000	-
Stage 2	-	-	-	-	-	-	817	1003	-	89	228	-
Critical Hdwy	4.14	-	-	4.6	-	-	7.9	6.54	7.62	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.45	-	-	3.7	4.02	3.66	3.52	4.02	3.32
Pot Cap-1 Maneuver	1182	-	-	1199	-	-	181	194	873	170	177	823
Stage 1	-	-	-	-	-	-	778	765	-	261	319	-
Stage 2	-	-	-	-	-	-	300	318	-	908	714	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1182	-	-	1199	-	-	138	142	873	102	130	823
Mov Cap-2 Maneuver	-	-	-	-	-	-	138	142	-	102	130	-
Stage 1	-	-	-	-	-	-	774	761	-	260	235	-
Stage 2	-	-	-	-	-	-	214	234	-	700	710	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	4.2	14.4	28.8
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	138	142	873	1182	-	-	1199	-	-	102	225
HCM Lane V/C Ratio	0.208	0.044	0.218	0.005	-	-	0.263	-	-	0.061	0.056
HCM Control Delay (s)	37.8	31.5	10.3	8.1	-	-	9.1	-	-	42.6	21.9
HCM Lane LOS	E	D	B	A	-	-	A	-	-	E	C
HCM 95th %tile Q(veh)	0.7	0.1	0.8	0	-	-	1.1	-	-	0.2	0.2

Intersection	
Int Delay, s/veh	7.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	301	32	118	245	5	56	5	348	5	5	5
Future Vol, veh/h	5	301	32	118	245	5	56	5	348	5	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	150	105	-	-	150	-	0	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	85	85	85	80	80	90	80	80	80
Heavy Vehicles, %	2	11	65	32	16	2	20	2	27	2	2	2
Mvmt Flow	6	354	38	139	288	6	70	6	387	6	6	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	294	0	0	392	0	0	791	938	177	761	973	147
Stage 1	-	-	-	-	-	-	366	366	-	569	569	-
Stage 2	-	-	-	-	-	-	425	572	-	192	404	-
Critical Hdwy	4.14	-	-	4.74	-	-	7.9	6.54	7.44	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.52	-	-	3.7	4.02	3.57	3.52	4.02	3.32
Pot Cap-1 Maneuver	1264	-	-	975	-	-	251	263	763	295	251	873
Stage 1	-	-	-	-	-	-	579	621	-	474	504	-
Stage 2	-	-	-	-	-	-	532	502	-	791	598	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1264	-	-	975	-	-	216	224	763	127	214	873
Mov Cap-2 Maneuver	-	-	-	-	-	-	216	224	-	127	214	-
Stage 1	-	-	-	-	-	-	576	618	-	472	432	-
Stage 2	-	-	-	-	-	-	446	430	-	384	595	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	3	16.9	22.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	216	224	763	1264	-	-	975	-	-	127	344
HCM Lane V/C Ratio	0.324	0.028	0.507	0.005	-	-	0.142	-	-	0.049	0.036
HCM Control Delay (s)	29.5	21.5	14.5	7.9	-	-	9.3	-	-	34.8	15.9
HCM Lane LOS	D	C	B	A	-	-	A	-	-	D	C
HCM 95th %tile Q(veh)	1.3	0.1	2.9	0	-	-	0.5	-	-	0.2	0.1

Intersection	
Int Delay, s/veh	13.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↱		↰	↑	↱	↰	↱	
Traffic Vol, veh/h	10	193	166	855	479	10	76	10	471	10	10	10
Future Vol, veh/h	10	193	166	855	479	10	76	10	471	10	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	150	105	-	-	150	-	0	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	90	85	85	85	85	90	80	80	80
Heavy Vehicles, %	2	11	33	22	15	2	20	2	27	2	2	2
Mvmt Flow	13	227	195	950	564	12	89	12	523	13	13	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	576	0	0	422	0	0	2442	2729	114	2616	2918	288
Stage 1	-	-	-	-	-	-	253	253	-	2470	2470	-
Stage 2	-	-	-	-	-	-	2189	2476	-	146	448	-
Critical Hdwy	4.14	-	-	4.54	-	-	7.9	6.54	7.44	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.42	-	-	3.7	4.02	3.57	3.52	4.02	3.32
Pot Cap-1 Maneuver	993	-	-	1003	-	-	~ 13	20	843	~ 12	15	709
Stage 1	-	-	-	-	-	-	680	696	-	31	59	-
Stage 2	-	-	-	-	-	-	~ 37	59	-	842	571	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	993	-	-	1003	-	-	-	~ 1	843	-	~ 1	709
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	~ 1	-	-	~ 1	-
Stage 1	-	-	-	-	-	-	671	687	-	31	~ 3	-
Stage 2	-	-	-	-	-	-	-	~ 3	-	310	564	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	23.4		
HCM LOS			-	-

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	-	1	843	993	-	-	1003	-	-	-	2
HCM Lane V/C Ratio	-	11.765	0.621	0.013	-	-	0.947	-	-	-	12.5
HCM Control Delay (s)	-	$ 11019.6	16	8.7	-	-	37.6	-	-	-	$ 8493.7
HCM Lane LOS	-	F	C	A	-	-	E	-	-	-	F
HCM 95th %tile Q(veh)	-	2.9	4.4	0	-	-	15.9	-	-	-	4.8

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	415.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	465	78	355	374	10	185	10	1091	10	10	10
Future Vol, veh/h	10	465	78	355	374	10	185	10	1091	10	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	150	105	-	-	150	-	0	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	85	85	90	85	85	85	85	90	80	80	80
Heavy Vehicles, %	2	11	46	25	16	2	20	2	23	2	2	2
Mvmt Flow	13	547	92	394	440	12	218	12	1212	13	13	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	639	0	0	1588	1813	274	1540	1899	226
Stage 1	-	-	-	-	-	-	573	573	-	1234	1234	-
Stage 2	-	-	-	-	-	-	1015	1240	-	306	665	-
Critical Hdwy	4.14	-	-	4.6	-	-	7.9	6.54	7.36	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.45	-	-	3.7	4.02	3.53	3.52	4.02	3.32
Pot Cap-1 Maneuver	1105	-	-	801	-	-	~ 61	78	~ 664	79	69	777
Stage 1	-	-	-	-	-	-	429	502	-	187	247	-
Stage 2	-	-	-	-	-	-	224	245	-	679	456	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1105	-	-	801	-	-	~ 27	39	~ 664	-	35	777
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 27	39	-	-	35	-
Stage 1	-	-	-	-	-	-	424	496	-	185	125	-
Stage 2	-	-	-	-	-	-	~ 101	124	-	-	451	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	6.4	$ 854.6	
HCM LOS			F	-

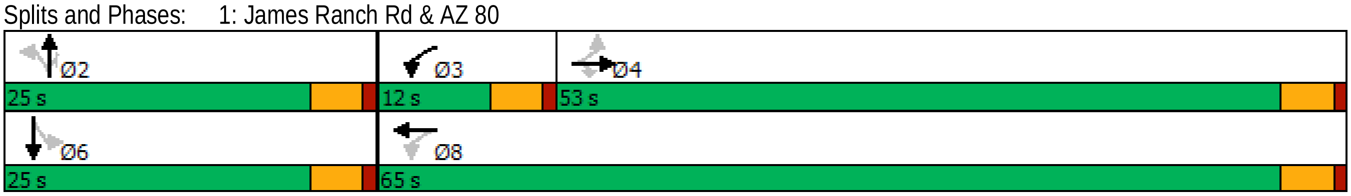
Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	27	39	664	1105	-	-	801	-	-	-	67
HCM Lane V/C Ratio	8.061	0.302	1.826	0.011	-	-	0.492	-	-	-	0.373
HCM Control Delay (s)	$ 3461.3	133.1	$ 393.6	8.3	-	-	13.8	-	-	-	87.7
HCM Lane LOS	F	F	F	A	-	-	B	-	-	-	F
HCM 95th %tile Q(veh)	26.9	1	74.6	0	-	-	2.8	-	-	-	1.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBTL
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	25	12	53	25	65
Maximum Split (%)	27.8%	13.3%	58.9%	27.8%	72.2%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	25	37	0	25
End Time (s)	25	37	0	25	0
Yield/Force Off (s)	20.5	32.5	85.5	20.5	85.5
Yield/Force Off 170(s)	9.5	32.5	85.5	9.5	85.5
Local Start Time (s)	0	25	37	0	25
Local Yield (s)	20.5	32.5	85.5	20.5	85.5
Local Yield 170(s)	9.5	32.5	85.5	9.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	55

Splits and Phases: 1: James Ranch Rd & AZ 80



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	125	59	268	312	5	23	5	162	5	5	5
Future Volume (veh/h)	5	125	59	268	312	5	23	5	162	5	5	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	1203	1530	1678	1870	1604	1870	1366	1870	1870	1870
Adj Flow Rate, veh/h	6	156	74	315	367	6	29	0	195	6	6	6
Peak Hour Factor	0.80	0.80	0.80	0.85	0.85	0.85	0.80	0.85	0.85	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	47	25	15	2	20	2	36	2	2	2
Cap, veh/h	442	595	184	1284	1679	27	436	0	353	441	131	131
Arrive On Green	0.18	0.18	0.18	0.18	0.52	0.52	0.15	0.00	0.15	0.15	0.15	0.15
Sat Flow, veh/h	1009	3300	1020	2826	3210	52	1202	0	2316	1188	858	858
Grp Volume(v), veh/h	6	156	74	315	182	191	29	0	195	6	0	12
Grp Sat Flow(s),veh/h/ln	1009	1650	1020	1413	1594	1668	1202	0	1158	1188	0	1716
Q Serve(g_s), s	0.1	1.1	1.8	2.0	1.7	1.7	0.6	0.0	2.2	0.1	0.0	0.2
Cycle Q Clear(g_c), s	0.1	1.1	1.8	2.0	1.7	1.7	0.8	0.0	2.2	0.1	0.0	0.2
Prop In Lane	1.00		1.00	1.00		0.03	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	442	595	184	1284	834	873	436	0	353	441	0	261
V/C Ratio(X)	0.01	0.26	0.40	0.25	0.22	0.22	0.07	0.00	0.55	0.01	0.00	0.05
Avail Cap(c_a), veh/h	2026	5773	1784	1539	3478	3640	1141	0	1713	1138	0	1269
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.4	9.8	10.0	5.2	3.6	3.6	10.4	0.0	10.9	10.0	0.0	10.0
Incr Delay (d2), s/veh	0.0	0.2	1.4	0.1	0.1	0.1	0.1	0.0	1.4	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.5	0.1	0.1	0.1	0.2	0.0	0.6	0.0	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.4	10.0	11.5	5.3	3.7	3.7	10.4	0.0	12.2	10.0	0.0	10.1
LnGrp LOS	A	B	B	A	A	A	B	A	B	B	A	B
Approach Vol, veh/h		236			688			224			18	
Approach Delay, s/veh		10.4			4.4			12.0			10.1	
Approach LOS		B			A			B			B	

Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		8.7	9.5	9.5		8.7		19.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		20.5	7.5	48.5		20.5		60.5				
Max Q Clear Time (g_c+I1), s		4.2	4.0	3.8		2.2		3.7				
Green Ext Time (p_c), s		0.8	0.4	1.1		0.0		1.9				

Intersection Summary			
HCM 6th Ctrl Delay			7.2
HCM 6th LOS			A

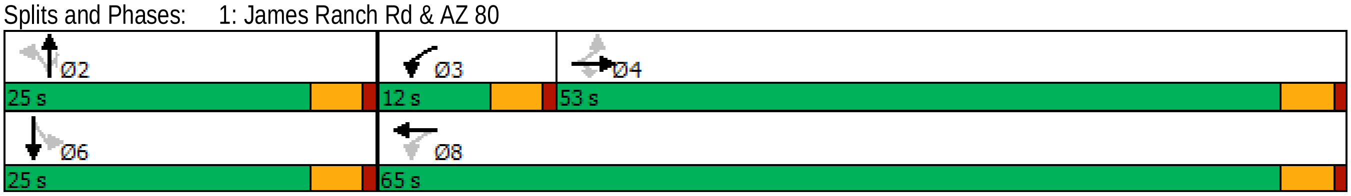
Notes

User approved volume balancing among the lanes for turning movement.

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBTL
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	25	12	53	25	65
Maximum Split (%)	27.8%	13.3%	58.9%	27.8%	72.2%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	25	37	0	25
End Time (s)	25	37	0	25	0
Yield/Force Off (s)	20.5	32.5	85.5	20.5	85.5
Yield/Force Off 170(s)	9.5	32.5	85.5	9.5	85.5
Local Start Time (s)	0	25	37	0	25
Local Yield (s)	20.5	32.5	85.5	20.5	85.5
Local Yield 170(s)	9.5	32.5	85.5	9.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	55

Splits and Phases: 1: James Ranch Rd & AZ 80



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	301	32	118	245	5	56	5	348	5	5	5
Future Volume (veh/h)	5	301	32	118	245	5	56	5	348	5	5	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	937	1426	1663	1870	1604	1870	1500	1870	1870	1870
Adj Flow Rate, veh/h	6	354	40	148	288	6	70	0	413	6	6	6
Peak Hour Factor	0.80	0.85	0.80	0.80	0.85	0.85	0.80	0.85	0.85	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	65	32	16	2	20	2	27	2	2	2
Cap, veh/h	443	716	172	973	1552	32	502	0	637	451	215	215
Arrive On Green	0.22	0.22	0.22	0.14	0.49	0.49	0.25	0.00	0.25	0.25	0.25	0.25
Sat Flow, veh/h	1085	3300	794	2634	3165	66	1202	0	2542	973	858	858
Grp Volume(v), veh/h	6	354	40	148	144	150	70	0	413	6	0	12
Grp Sat Flow(s),veh/h/ln	1085	1650	794	1317	1580	1651	1202	0	1271	973	0	1716
Q Serve(g_s), s	0.2	3.3	1.4	1.2	1.8	1.8	1.6	0.0	5.0	0.2	0.0	0.2
Cycle Q Clear(g_c), s	0.2	3.3	1.4	1.2	1.8	1.8	1.8	0.0	5.0	0.2	0.0	0.2
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	443	716	172	973	775	810	502	0	637	451	0	430
V/C Ratio(X)	0.01	0.49	0.23	0.15	0.19	0.19	0.14	0.00	0.65	0.01	0.00	0.03
Avail Cap(c_a), veh/h	1722	4608	1108	1163	2751	2876	910	0	1500	782	0	1013
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	11.9	11.2	6.7	5.0	5.0	10.5	0.0	11.6	9.8	0.0	9.8
Incr Delay (d2), s/veh	0.0	0.5	0.7	0.1	0.1	0.1	0.1	0.0	1.1	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	1.4	0.3	0.2	0.3	0.3	0.6	0.0	1.6	0.0	0.0	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.7	12.5	11.9	6.7	5.1	5.1	10.6	0.0	12.8	9.8	0.0	9.8
LnGrp LOS	B	B	B	A	A	A	B	A	B	A	A	A
Approach Vol, veh/h		400			442			483			18	
Approach Delay, s/veh		12.4			5.6			12.5			9.8	
Approach LOS		B			A			B			A	
Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		13.2	9.5	12.0		13.2		21.5				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		20.5	7.5	48.5		20.5		60.5				
Max Q Clear Time (g_c+I1), s		7.0	3.2	5.3		2.2		3.8				
Green Ext Time (p_c), s		1.7	0.2	2.3		0.0		1.5				
Intersection Summary												
HCM 6th Ctrl Delay			10.2									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBT
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	25	27	38	25	65
Maximum Split (%)	27.8%	30.0%	42.2%	27.8%	72.2%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	25	52	0	25
End Time (s)	25	52	0	25	0
Yield/Force Off (s)	20.5	47.5	85.5	20.5	85.5
Yield/Force Off 170(s)	9.5	47.5	85.5	9.5	85.5
Local Start Time (s)	0	25	52	0	25
Local Yield (s)	20.5	47.5	85.5	20.5	85.5
Local Yield 170(s)	9.5	47.5	85.5	9.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 1: James Ranch Rd & AZ 80

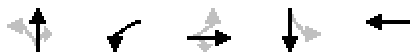
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	193	166	855	479	10	76	10	471	10	10	10
Future Volume (veh/h)	10	193	166	855	479	10	76	10	471	10	10	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	1411	1574	1678	1870	1604	1870	1500	1870	1870	1870
Adj Flow Rate, veh/h	12	227	195	950	564	12	95	0	507	12	12	12
Peak Hour Factor	0.80	0.85	0.85	0.90	0.85	0.85	0.80	0.85	0.85	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	33	22	15	2	20	2	27	2	2	2
Cap, veh/h	287	701	254	993	1986	42	383	0	613	324	207	207
Arrive On Green	0.21	0.21	0.21	0.34	0.62	0.62	0.24	0.00	0.24	0.24	0.24	0.24
Sat Flow, veh/h	837	3300	1196	2908	3191	68	1189	0	2542	892	858	858
Grp Volume(v), veh/h	12	227	195	950	281	295	95	0	507	12	0	24
Grp Sat Flow(s),veh/h/ln	837	1650	1196	1454	1594	1665	1189	0	1271	892	0	1716
Q Serve(g_s), s	0.8	3.8	10.1	21.0	5.3	5.3	4.4	0.0	12.5	0.7	0.0	0.7
Cycle Q Clear(g_c), s	0.8	3.8	10.1	21.0	5.3	5.3	5.1	0.0	12.5	0.7	0.0	0.7
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	287	701	254	993	992	1036	383	0	613	324	0	414
V/C Ratio(X)	0.04	0.32	0.77	0.96	0.28	0.28	0.25	0.00	0.83	0.04	0.00	0.06
Avail Cap(c_a), veh/h	535	1679	608	993	1464	1530	467	0	791	387	0	534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.7	21.9	24.4	21.2	5.7	5.7	21.2	0.0	23.7	19.2	0.0	19.2
Incr Delay (d2), s/veh	0.1	0.3	4.9	18.9	0.2	0.1	0.3	0.0	5.7	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.2	2.3	5.0	13.0	1.9	1.9	2.1	0.0	6.5	0.2	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.8	22.2	29.3	40.1	5.9	5.9	21.5	0.0	29.4	19.3	0.0	19.3
LnGrp LOS	C	C	C	D	A	A	C	A	C	B	A	B
Approach Vol, veh/h		434			1526			602			36	
Approach Delay, s/veh		25.3			27.2			28.2			19.3	
Approach LOS		C			C			C			B	

Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		20.4	27.0	18.5		20.4		45.5				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		20.5	22.5	33.5		20.5		60.5				
Max Q Clear Time (g_c+I1), s		14.5	23.0	12.1		2.7		7.3				
Green Ext Time (p_c), s		1.4	0.0	1.9		0.1		3.2				

Intersection Summary			
HCM 6th Ctrl Delay			27.0
HCM 6th LOS			C

Notes

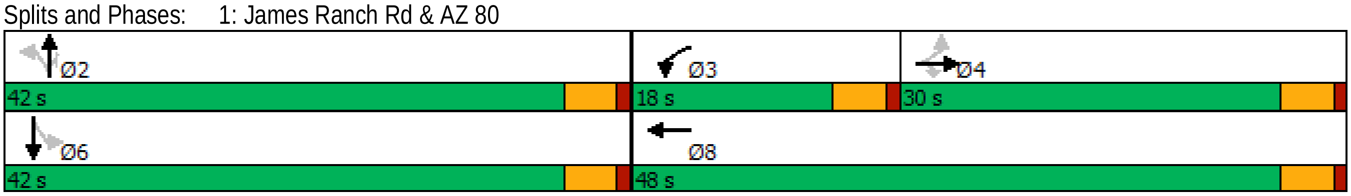
User approved volume balancing among the lanes for turning movement.



Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBT
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	42	18	30	42	48
Maximum Split (%)	46.7%	20.0%	33.3%	46.7%	53.3%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	42	60	0	42
End Time (s)	42	60	0	42	0
Yield/Force Off (s)	37.5	55.5	85.5	37.5	85.5
Yield/Force Off 170(s)	26.5	55.5	85.5	26.5	85.5
Local Start Time (s)	0	42	60	0	42
Local Yield (s)	37.5	55.5	85.5	37.5	85.5
Local Yield 170(s)	26.5	55.5	85.5	26.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 1: James Ranch Rd & AZ 80



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	465	78	355	374	10	185	10	1091	10	10	10
Future Volume (veh/h)	10	465	78	355	374	10	185	10	1091	10	10	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	1218	1530	1663	1870	1604	1870	1559	1870	1870	1870
Adj Flow Rate, veh/h	12	547	98	418	440	12	218	0	1098	12	12	12
Peak Hour Factor	0.80	0.85	0.80	0.85	0.85	0.85	0.85	0.90	0.90	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	46	25	16	2	20	2	23	2	2	2
Cap, veh/h	292	708	222	477	1382	38	613	0	1182	320	384	384
Arrive On Green	0.21	0.21	0.21	0.17	0.44	0.44	0.45	0.00	0.45	0.45	0.45	0.45
Sat Flow, veh/h	939	3300	1032	2826	3142	86	1189	0	2643	514	858	858
Grp Volume(v), veh/h	12	547	98	418	221	231	218	0	1098	12	0	24
Grp Sat Flow(s),veh/h/ln	939	1650	1032	1413	1580	1647	1189	0	1321	514	0	1716
Q Serve(g_s), s	0.8	12.5	6.6	11.5	7.3	7.3	10.1	0.0	31.4	1.1	0.0	0.6
Cycle Q Clear(g_c), s	0.8	12.5	6.6	11.5	7.3	7.3	10.7	0.0	31.4	1.1	0.0	0.6
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	292	708	222	477	695	725	613	0	1182	320	0	768
V/C Ratio(X)	0.04	0.77	0.44	0.88	0.32	0.32	0.36	0.00	0.93	0.04	0.00	0.03
Avail Cap(c_a), veh/h	390	1053	329	477	860	897	639	0	1240	331	0	805
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.0	29.5	27.2	32.4	14.6	14.6	15.4	0.0	20.9	12.5	0.0	12.4
Incr Delay (d2), s/veh	0.1	2.1	1.4	16.5	0.3	0.3	0.3	0.0	11.9	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	8.1	2.8	8.2	4.0	4.2	4.7	0.0	14.8	0.2	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.0	31.6	28.6	48.9	14.8	14.8	15.7	0.0	32.7	12.5	0.0	12.4
LnGrp LOS	C	C	C	D	B	B	B	A	C	B	A	B
Approach Vol, veh/h		657			870			1316			36	
Approach Delay, s/veh		31.0			31.2			29.9			12.4	
Approach LOS		C			C			C			B	
Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		40.3	18.0	21.7		40.3		39.7				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		37.5	13.5	25.5		37.5		43.5				
Max Q Clear Time (g_c+I1), s		33.4	13.5	14.5		3.1		9.3				
Green Ext Time (p_c), s		2.4	0.0	2.7		0.2		2.3				
Intersection Summary												
HCM 6th Ctrl Delay			30.3									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBT
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	23	44	23	23	67
Maximum Split (%)	25.6%	48.9%	25.6%	25.6%	74.4%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	23	67	0	23
End Time (s)	23	67	0	23	0
Yield/Force Off (s)	18.5	62.5	85.5	18.5	85.5
Yield/Force Off 170(s)	7.5	62.5	85.5	7.5	85.5
Local Start Time (s)	0	23	67	0	23
Local Yield (s)	18.5	62.5	85.5	18.5	85.5
Local Yield 170(s)	7.5	62.5	85.5	7.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	90

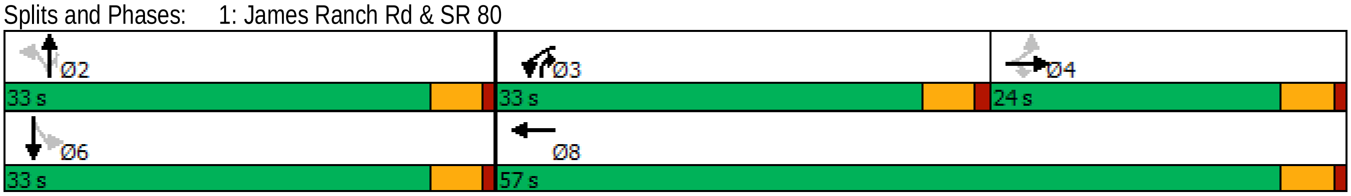
Splits and Phases: 1: James Ranch Rd & SR 80

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱		↰	↑	↱↱	↰	↱	
Traffic Volume (veh/h)	10	193	166	855	479	10	76	10	471	10	10	10
Future Volume (veh/h)	10	193	166	855	479	10	76	10	471	10	10	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	1411	1574	1678	1870	1604	1870	1500	1870	1870	1870
Adj Flow Rate, veh/h	16	295	254	1235	733	15	124	16	720	16	16	16
Peak Hour Factor	0.80	0.85	0.85	0.90	0.85	0.85	0.80	0.80	0.85	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	33	22	15	2	20	2	27	2	2	2
Cap, veh/h	229	686	249	1281	2233	46	299	374	1433	220	171	171
Arrive On Green	0.21	0.21	0.21	0.44	0.70	0.70	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	713	3300	1196	2908	3194	65	1181	1870	2237	722	858	858
Grp Volume(v), veh/h	16	295	254	1235	366	382	124	16	720	16	0	32
Grp Sat Flow(s),veh/h/ln	713	1650	1196	1454	1594	1666	1181	1870	1119	722	0	1716
Q Serve(g_s), s	1.6	6.9	18.5	36.7	8.0	8.0	8.5	0.6	15.2	1.6	0.0	1.4
Cycle Q Clear(g_c), s	1.6	6.9	18.5	36.7	8.0	8.0	9.9	0.6	15.2	2.2	0.0	1.4
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	229	686	249	1281	1114	1165	299	374	1433	220	0	343
V/C Ratio(X)	0.07	0.43	1.02	0.96	0.33	0.33	0.41	0.04	0.50	0.07	0.00	0.09
Avail Cap(c_a), veh/h	229	686	249	1291	1120	1170	308	389	1451	226	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.6	30.6	35.2	24.2	5.2	5.2	33.0	28.7	8.5	29.6	0.0	29.0
Incr Delay (d2), s/veh	0.1	0.4	62.8	17.1	0.2	0.2	0.9	0.0	0.3	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.5	4.6	14.4	19.6	3.0	3.1	4.4	0.5	4.7	0.5	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.7	31.1	98.0	41.3	5.4	5.4	34.0	28.8	8.8	29.8	0.0	29.1
LnGrp LOS	C	C	F	D	A	A	C	C	A	C	A	C
Approach Vol, veh/h		565			1983			860			48	
Approach Delay, s/veh		61.1			27.7			12.8			29.4	
Approach LOS		E			C			B			C	
Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		22.3	43.7	23.0		22.3		66.7				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		18.5	39.5	18.5		18.5		62.5				
Max Q Clear Time (g_c+I1), s		17.2	38.7	20.5		4.2		10.0				
Green Ext Time (p_c), s		0.6	0.4	0.0		0.1		4.4				
Intersection Summary												
HCM 6th Ctrl Delay			29.5									
HCM 6th LOS			C									

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBT
Lead/Lag		Lead	Lag		
Lead-Lag Optimize					
Recall Mode	None	Min	Min	None	Min
Maximum Split (s)	33	33	24	33	57
Maximum Split (%)	36.7%	36.7%	26.7%	36.7%	63.3%
Minimum Split (s)	22.5	9.5	22.5	22.5	22.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1
Minimum Initial (s)	5	5	5	5	5
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	7		7	7	7
Flash Dont Walk (s)	11		11	11	11
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	33	66	0	33
End Time (s)	33	66	0	33	0
Yield/Force Off (s)	28.5	61.5	85.5	28.5	85.5
Yield/Force Off 170(s)	17.5	61.5	85.5	17.5	85.5
Local Start Time (s)	0	33	66	0	33
Local Yield (s)	28.5	61.5	85.5	28.5	85.5
Local Yield 170(s)	17.5	61.5	85.5	17.5	85.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 1: James Ranch Rd & SR 80



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	465	78	355	374	10	185	10	1091	10	10	10
Future Volume (veh/h)	10	465	78	355	374	10	185	10	1091	10	10	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1737	1218	1530	1663	1870	1604	1870	1559	1870	1870	1870
Adj Flow Rate, veh/h	16	711	127	543	572	15	283	16	1576	16	16	16
Peak Hour Factor	0.80	0.85	0.80	0.85	0.85	0.85	0.85	0.80	0.90	0.80	0.80	0.80
Percent Heavy Veh, %	2	11	46	25	16	2	20	2	23	2	2	2
Cap, veh/h	290	793	248	646	1654	43	502	674	1370	205	309	309
Arrive On Green	0.24	0.24	0.24	0.23	0.53	0.53	0.36	0.36	0.36	0.36	0.36	0.36
Sat Flow, veh/h	829	3300	1032	2826	3145	82	1181	1870	2325	320	858	858
Grp Volume(v), veh/h	16	711	127	543	287	300	283	16	1576	16	0	32
Grp Sat Flow(s),veh/h/ln	829	1650	1032	1413	1580	1648	1181	1870	1163	320	0	1716
Q Serve(g_s), s	1.2	16.5	8.4	14.5	8.3	8.3	16.3	0.4	28.5	2.7	0.0	1.0
Cycle Q Clear(g_c), s	1.2	16.5	8.4	14.5	8.3	8.3	17.2	0.4	28.5	3.1	0.0	1.0
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.50
Lane Grp Cap(c), veh/h	290	793	248	646	831	867	502	674	1370	205	0	618
V/C Ratio(X)	0.06	0.90	0.51	0.84	0.35	0.35	0.56	0.02	1.15	0.08	0.00	0.05
Avail Cap(c_a), veh/h	295	814	255	1018	1048	1094	502	674	1370	205	0	618
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.3	29.1	26.0	29.1	10.9	10.9	22.1	16.3	16.3	17.3	0.0	16.5
Incr Delay (d2), s/veh	0.1	12.5	1.6	3.7	0.2	0.2	1.5	0.0	76.6	0.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	11.5	3.5	8.2	4.1	4.3	7.9	0.3	33.7	0.4	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.4	41.5	27.7	32.8	11.1	11.1	23.6	16.3	92.9	17.5	0.0	16.5
LnGrp LOS	C	D	C	C	B	B	C	B	F	B	A	B
Approach Vol, veh/h		854			1130			1875			48	
Approach Delay, s/veh		39.1			21.6			81.8			16.9	
Approach LOS		D			C			F			B	
Timer - Assigned Phs		2	3	4		6		8				
Phs Duration (G+Y+Rc), s		33.0	22.6	23.5		33.0		46.1				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5		4.5				
Max Green Setting (Gmax), s		28.5	28.5	19.5		28.5		52.5				
Max Q Clear Time (g_c+I1), s		30.5	16.5	18.5		5.1		10.3				
Green Ext Time (p_c), s		0.0	1.6	0.5		0.4		3.2				
Intersection Summary												
HCM 6th Ctrl Delay			54.2									
HCM 6th LOS			D									

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2028 PHF Flow Profile (veh)
2028 Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	162	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 1958	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2028 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	23	5	0	162	30.0	1.00	0.850
2	SR 80	0	268	312	5	0	21.0	1.00	0.850
3	James Ranch Road	0	5	5	5	0	2.0	1.00	0.800
4	SR 80	0	5	125	59	0	18.0	1.00	0.850

Operational Results

2028 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	28	162	135	0	332	1225	1054	0.0228	0.1537
2	SR 80	None	585		33		292	1464		0.3995	
3	James Ranch Road	None	15		603		15	823		0.0182	
4	SR 80	None	189		278		340	1408		0.1342	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	2.97	1.54	1.75	0.07	0.00	A	A	A
2	SR 80	None	8.19		8.19	2.98		A		A
3	James Ranch Road	None	4.49		4.49	0.06		A		A
4	SR 80	None	4.74		4.74	0.60		A		A

Global Results

Performance and Accidents

2028 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	817	162	979
Capacity	veh/hr	4921	1054	5975
Average Delay	sec/veh	6.27	0.77	5.36
L.O.S. (Signal)	A – F	A	A	A
L.O.S. (Unsig)	A – F	A	A	A
Total Delay	veh.hrs	1.42	0.03	1.46

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2028 PHF Flow Profile (veh)
2028 Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Nighttime conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	348	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 288	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2028 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	56	5	0	348	30.0	1.00	0.850
2	SR 80	0	118	245	5	0	21.0	1.00	0.850
3	James Ranch Road	0	5	5	5	0	2.0	1.00	0.800
4	SR 80	0	5	301	32	0	18.0	1.00	0.850

Operational Results

2028 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	61	348	311	0	155	1084	1001	0.0563	0.3475
2	SR 80	None	368		66		654	1372		0.2683	
3	James Ranch Road	None	15		419		15	837		0.0179	
4	SR 80	None	338		128		306	1412		0.2394	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	3.35	2.74	2.83	0.16	0.00	A	A	A
2	SR 80	None	6.16		6.16	1.35		A		A
3	James Ranch Road	None	4.41		4.41	0.06		A		A
4	SR 80	None	4.97		4.97	0.91		A		A

Global Results

Performance and Accidents

2028 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	782	348	1130
Capacity	veh/hr	4705	1001	5706
Average Delay	sec/veh	4.47	1.74	3.63
L.O.S. (Signal)	A – F	A	A	A
L.O.S. (Unsig)	A – F	A	A	A
Total Delay	veh.hrs	0.97	0.17	1.14

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
2050 Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	471	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 1344	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2050 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	76	10	0	471	24.0	1.00	0.850
2	SR 80	0	855	479	10	0	20.0	1.00	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.00	0.800
4	SR 80	0	10	193	166	0	17.0	1.00	0.850

Operational Results

2050 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	86	471	213	0	1024	1311	1105	0.0656	0.4262
2	SR 80	None	1344		96		674	1456		0.9233	
3	James Ranch Road	None	30		1399		30	536		0.0559	
4	SR 80	None	369		868		561	1110		0.3324	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	3.21	3.13	3.14	0.20	0.00	A	A	A
2	SR 80	None	18.87		18.87	18.43		C		C
3	James Ranch Road	None	7.45		7.45	0.21		A		A
4	SR 80	None	9.37		9.37	2.45		A		A

Global Results

Performance and Accidents

2050 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1829	471	2300
Capacity	veh/hr	4413	1105	5518
Average Delay	sec/veh	15.08	2.13	12.43
L.O.S. (Signal)	A – F	B	A	B
L.O.S. (Unsig)	A – F	C	A	B
Total Delay	veh.hrs	7.66	0.28	7.94

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
2050 Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Nighttime conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	1091	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 1152	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2050 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	185	10	0	1091	24.0	1.00	0.900
2	SR 80	0	355	374	10	0	20.0	1.00	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.00	0.800
4	SR 80	0	10	465	78	0	17.0	1.00	0.850

Operational Results

2050 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	195	1091	485	0	443	1109	1049	0.1759	1.0396
2	SR 80	None	739		205		1524	1322		0.5592	
3	James Ranch Road	None	30		914		30	658		0.0456	
4	SR 80	None	553		375		569	1302		0.4248	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	4.77	23.33	20.51	0.54	40.81	A	C	C
2	SR 80	None	11.41		11.41	5.15		B		B
3	James Ranch Road	None	5.99		5.99	0.17		A		A
4	SR 80	None	7.10		7.10	2.29		A		A

Global Results

Performance and Accidents

2050 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1517	1091	2608
Capacity	veh/hr	4391	1049	5440
Average Delay	sec/veh	7.91	22.33	13.94
L.O.S. (Signal)	A – F	A	C	B
L.O.S. (Unsig)	A – F	A	C	B
Total Delay	veh.hrs	3.33	6.77	10.10

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
TI Sensitivity Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	471	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 3149	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2050 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	76	10	0	471	24.0	1.20	0.850
2	SR 80	0	855	479	10	0	20.0	1.20	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.20	0.800
4	SR 80	0	10	193	166	0	17.0	1.20	0.850

Operational Results

2050 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	103	565	256	0	1131	1290	1105	0.0800	0.5115
2	SR 80	None	1613		115		809	1445		1.1158	
3	James Ranch Road	None	36		1526		35	490		0.0734	
4	SR 80	None	443		943		618	1069		0.4142	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	3.40	3.56	3.53	0.25	0.00	A	A	A
2	SR 80	None	46.76		46.76	77.26		E		E
3	James Ranch Road	None	8.32		8.32	0.26		A		A
4	SR 80	None	10.75		10.75	3.25		B		B

Global Results

Performance and Accidents

2050 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	2195	565	2760
Capacity	veh/hr	4295	1105	5400
Average Delay	sec/veh	35.86	2.56	29.04
L.O.S. (Signal)	A – F	D	A	C
L.O.S. (Unsig)	A – F	E	A	D
Total Delay	veh.hrs	21.86	0.40	22.27

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
TI Sensitivity Roundabout, NBR Bypass	7.5 min Time Slice
Rodel-Win1	Control Delays (sec)
Right Hand Drive	Nighttime conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	James Ranch Road	0	0	24.00	2	24.00	2	0.00	90.00	40.00
2	SR 80	83	0	24.00	2	24.00	2	0.00	90.00	40.00
3	James Ranch Road	180	0	12.00	1	12.00	1	0.00	90.00	40.00
4	SR 80	263	0	24.00	2	24.00	2	0.00	90.00	40.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	James Ranch Road	200.00	30.00	2	24.00	2	24.00	2
2	SR 80	200.00	30.00	2	24.00	2	24.00	2
3	James Ranch Road	200.00	30.00	2	13.00	1	12.00	1
4	SR 80	200.00	30.00	2	24.00	2	24.00	2

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	James Ranch Road	0	1.000	0	1.000	36.00	5377	0	24.00	3584	0
2	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0
3	James Ranch Road	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	SR 80	0	1.000	0	1.000	20.00	3584	0	24.00	3584	0

Bypass Geometry

Bypass Approach Geometry (ft)

Leg	Leg Names	Bypass Type	Bypass Flows	V	nv	Vb	nvb	Vt	nvt
1	James Ranch Road	Free	1091	24	2	12	1	36	3

Bypass Entry and Exit Geometry (ft)

Leg	Leg Names	Entry Geometry						Leg	Leg Names	Exit Lanes	
		Eb	neb	Lb	Lt	Rb	Phib			nex	Nmx
1	James Ranch Road	12	1	0	130	120.000 3341	30	2	SR 80	2	2

Bypass Entry Capacity Modifiers and Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Calibration	
		Capacity + or -	Cross Walk Factor	Intercept + or -	Slope Factor
1	James Ranch Road	0	1.000	0	1.000

Traffic Flow Data (veh/hr)

2050 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	185	10	0	1091	24.0	1.10	0.900
2	SR 80	0	355	374	10	0	20.0	1.10	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.10	0.800
4	SR 80	0	10	465	78	0	17.0	1.10	0.850

Operational Results

2050 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	James Ranch Road	Free	215	1200	533	0	487	1086	1049	0.1975	1.1436
2	SR 80	None	813		225		1572	1310		0.6203	
3	James Ranch Road	None	33		1005		33	625		0.0528	
4	SR 80	None	608		412		626	1281		0.4747	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	James Ranch Road	Free	5.08	60.97	52.50	0.63	69.53	A	F	F
2	SR 80	None	12.57		12.57	6.37		B		B
3	James Ranch Road	None	6.41		6.41	0.19		A		A
4	SR 80	None	7.71		7.71	2.80		A		A

Global Results

Performance and Accidents

2050 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1669	1200	2869
Capacity	veh/hr	4303	1049	5352
Average Delay	sec/veh	8.73	59.97	30.17
L.O.S. (Signal)	A – F	A	E	C
L.O.S. (Unsig)	A – F	A	F	D
Total Delay	veh.hrs	4.05	19.99	24.04

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2028 PHF Flow Profile (veh)
2028 Roundabout	7.5 min Time Slice
HCM 2010 Model	Control Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

HCM Lanes and Headways

HCM 2016 Bearings and Lanes

Leg	Leg Names	Bearing (deg)	Lanes			
			Approach Lanes	Entry Lanes	Circulating Lanes	Exit Lanes
1	James Ranch Road	0	2	2	2	2
2	SR 80	83	2	2	2	2
3	James Ranch Road	180	1	1	2	1
4	SR 80	263	2	2	2	2

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Calibrated Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			3.186	5.193	3.186	5.193
1	2			3.186	4.113	3.186	4.113
2	2	3.186	4.293	3.186	4.113		
2	1	3.186	5.193	3.186	5.193		

HCM 2016 Derived Intercept and Exponential for HCM or Calibration

Leg	Leg Names	Intercept (pcs/hr)				Exponent (×1000)			
		tf	L1	L2	Bp	tf, tc	L1	L2	Bp
1	James Ranch Road	HCM	1350	1420		HCM	0.92	0.85	
2	SR 80	HCM	1350	1420		HCM	0.92	0.85	
3	James Ranch Road	HCM		1420		HCM		0.85	
4	SR 80	HCM	1350	1420		HCM	0.92	0.85	

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	James Ranch Road	0.47	0.53	None	0	1.000	0.85
2	SR 80	0.47	0.53	None	0	1.000	0.85
3	James Ranch Road	0.00	1.00	None	0	1.000	0.80
4	SR 80	0.47	0.53	None	0	1.000	0.85

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	James Ranch Road	0	1.000	30.0	1.00
2	SR 80	0	1.000	21.0	1.00
3	James Ranch Road	0	1.000	2.0	1.00
4	SR 80	0	1.000	18.0	1.00

Traffic Flow Data (veh/hr)

2028 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	23	5	162	0	30.0	1.00	0.850
2	SR 80	0	268	312	5	0	21.0	1.00	0.850
3	James Ranch Road	0	5	5	5	0	2.0	1.00	0.800
4	SR 80	0	5	125	59	0	18.0	1.00	0.850

Operational Results

HCM 2016 - 2028 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	James Ranch Road	89	101		135		897	954		0.099	0.106	
2	SR 80	275	310		34		1072	1131		0.256	0.274	
3	James Ranch Road		15		603			747			0.020	
4	SR 80	89	100		278		841	906		0.106	0.110	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	James Ranch Road	5.0	4.7		4.8	0.3	0.4		A	A		A
2	SR 80	5.8	5.8		5.8	1.0	1.1		A	A		A
3	James Ranch Road		5.0		5.0		0.1			A		A
4	SR 80	5.3	5.0		5.2	0.4	0.4		A	A		A

Global Results

Performance and Accidents

2028 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	979		979
Capacity	veh/hr	6707		10466
Average Delay	sec/veh	10.85		10.85
L.O.S. (Signal)	A – F	B		B
L.O.S. (Unsig)	A – F	B		B
Total Delay	veh.hrs	2.95		2.95

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2028 PHF Flow Profile (veh)
2028 Roundabout	7.5 min Time Slice
HCM 2010 Model	Control Delays (sec)
Right Hand Drive	Nighttime conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Operational Data

HCM Lanes and Headways

HCM 2016 Bearings and Lanes

Leg	Leg Names	Bearing (deg)	Lanes			
			Approach Lanes	Entry Lanes	Circulating Lanes	Exit Lanes
1	James Ranch Road	0	2	2	2	2
2	SR 80	83	2	2	2	2
3	James Ranch Road	180	1	1	2	1
4	SR 80	263	2	2	2	2

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Calibrated Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			3.186	5.193	3.186	5.193
1	2			3.186	4.113	3.186	4.113
2	2	3.186	4.293	3.186	4.113		
2	1	3.186	5.193	3.186	5.193		

HCM 2016 Derived Intercept and Exponential for HCM or Calibration

Leg	Leg Names	Intercept (pcs/hr)				Exponent (×1000)			
		tf	L1	L2	Bp	tf, tc	L1	L2	Bp
1	James Ranch Road	HCM	1350	1420		HCM	0.92	0.85	
2	SR 80	HCM	1350	1420		HCM	0.92	0.85	
3	James Ranch Road	HCM		1420		HCM		0.85	
4	SR 80	HCM	1350	1420		HCM	0.92	0.85	

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	James Ranch Road	0.47	0.53	None	0	1.000	0.85
2	SR 80	0.47	0.53	None	0	1.000	0.85
3	James Ranch Road	0.00	1.00	None	0	1.000	0.80
4	SR 80	0.47	0.53	None	0	1.000	0.85

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	James Ranch Road	0	1.000	30.0	1.00
2	SR 80	0	1.000	21.0	1.00
3	James Ranch Road	0	1.000	2.0	1.00
4	SR 80	0	1.000	18.0	1.00

Traffic Flow Data (veh/hr)

2028 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	56	5	348	0	30.0	1.00	0.850
2	SR 80	0	118	245	5	0	21.0	1.00	0.850
3	James Ranch Road	0	5	5	5	0	2.0	1.00	0.800
4	SR 80	0	5	301	32	0	18.0	1.00	0.850

Operational Results

HCM 2016 - 2028 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	James Ranch Road	192	217		311		704	760		0.273	0.285	
2	SR 80	173	195		67		979	1036		0.177	0.188	
3	James Ranch Road		15		419			856			0.018	
4	SR 80	159	179		128		944	1004		0.168	0.178	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	James Ranch Road	8.4	8.1		8.2	1.1	1.2		A	A		A
2	SR 80	5.3	5.2		5.3	0.6	0.7		A	A		A
3	James Ranch Road		4.4		4.4		0.1			A		A
4	SR 80	5.4	5.3		5.3	0.6	0.7		A	A		A

Global Results

Performance and Accidents

2028 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1130		1130
Capacity	veh/hr	6481		10003
Average Delay	sec/veh	12.64		12.64
L.O.S. (Signal)	A – F	B		B
L.O.S. (Unsig)	A – F	B		B
Total Delay	veh.hrs	3.97		3.97

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
2050 Roundabout	7.5 min Time Slice
HCM 2010 Model	Control Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Available Data

Entry Capacity Calibrated	No
Entry Capacity Modified	No
Crosswalks	No
Flows Factored	No
Approach/Exit Road Capacity Calibrated	No
Accidents	No
Accident Costs	No
Bypass Model	No
Bypass Calibration	No
Global Results	Yes

Operational Data

HCM Lanes and Headways

HCM 2016 Bearings and Lanes

Leg	Leg Names	Bearing (deg)	Lanes			
			Approach Lanes	Entry Lanes	Circulating Lanes	Exit Lanes
1	James Ranch Road	0	2	2	2	2
2	SR 80	83	2	2	2	2
3	James Ranch Road	180	1	1	2	1
4	SR 80	263	2	2	2	2

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Calibrated Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			3.186	5.193	3.186	5.193
1	2			3.186	4.113	3.186	4.113
2	2	3.186	4.293	3.186	4.113		
2	1	3.186	5.193	3.186	5.193		

HCM 2016 Derived Intercept and Exponential for HCM or Calibration

Leg	Leg Names	Intercept (pcs/hr)				Exponent (×1000)			
		tf	L1	L2	Bp	tf, tc	L1	L2	Bp
1	James Ranch Road	HCM	1350	1420		HCM	0.92	0.85	
2	SR 80	HCM	1350	1420		HCM	0.92	0.85	
3	James Ranch Road	HCM		1420		HCM		0.85	
4	SR 80	HCM	1350	1420		HCM	0.92	0.85	

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	James Ranch Road	0.47	0.53	None	0	1.000	0.85
2	SR 80	0.47	0.53	None	0	1.000	0.90
3	James Ranch Road	0.00	1.00	None	0	1.000	0.80
4	SR 80	0.47	0.53	None	0	1.000	0.85

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	James Ranch Road	0	1.000	24.0	1.00
2	SR 80	0	1.000	20.0	1.00
3	James Ranch Road	0	1.000	2.0	1.00
4	SR 80	0	1.000	17.0	1.00

Traffic Flow Data (veh/hr)

2050 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	76	10	471	0	24.0	1.00	0.850
2	SR 80	0	855	479	10	0	20.0	1.00	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.00	0.800
4	SR 80	0	10	193	166	0	17.0	1.00	0.850

Operational Results

HCM 2016 - 2050 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	James Ranch Road	262	295		213		867	928		0.302	0.318	
2	SR 80	632	712		96		1009	1070		0.626	0.665	
3	James Ranch Road		30		1410			330			0.091	
4	SR 80	173	196		875		441	499		0.392	0.393	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	James Ranch Road	7.5	7.3		7.4	1.3	1.4		A	A		A
2	SR 80	12.6	13.3		13.0	4.9	5.8		B	B		B
3	James Ranch Road		12.5		12.5		0.3			B		B
4	SR 80	15.4	13.8		14.6	1.9	1.9		C	B		B

Global Results

Performance and Accidents

2050 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	2300		2300
Capacity	veh/hr	5190		8077
Average Delay	sec/veh	23.57		23.57
L.O.S. (Signal)	A – F	C		C
L.O.S. (Unsig)	A – F	C		C
Total Delay	veh.hrs	15.06		15.06

Scheme Summary

Control Data

Control Data and Model Parameters

Douglas IPOE	2050 PHF Flow Profile (veh)
2050 Roundabout	7.5 min Time Slice
HCM 2010 Model	Control Delays (sec)
Right Hand Drive	Nighttime conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Available Data

Entry Capacity Calibrated	No
Entry Capacity Modified	No
Crosswalks	No
Flows Factored	No
Approach/Exit Road Capacity Calibrated	No
Accidents	No
Accident Costs	No
Bypass Model	No
Bypass Calibration	No
Global Results	Yes

Operational Data

HCM Lanes and Headways

HCM 2016 Bearings and Lanes

Leg	Leg Names	Bearing (deg)	Lanes			
			Approach Lanes	Entry Lanes	Circulating Lanes	Exit Lanes
1	James Ranch Road	0	2	2	2	2
2	SR 80	83	2	2	2	2
3	James Ranch Road	180	1	1	2	1
4	SR 80	263	2	2	2	2

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Calibrated Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			3.186	5.193	3.186	5.193
1	2			3.186	4.113	3.186	4.113
2	2	3.186	4.293	3.186	4.113		
2	1	3.186	5.193	3.186	5.193		

HCM 2016 Derived Intercept and Exponential for HCM or Calibration

Leg	Leg Names	Intercept (pcs/hr)				Exponent (×1000)			
		tf	L1	L2	Bp	tf, tc	L1	L2	Bp
1	James Ranch Road	HCM	1350	1420		HCM	0.92	0.85	
2	SR 80	HCM	1350	1420		HCM	0.92	0.85	
3	James Ranch Road	HCM		1420		HCM		0.85	
4	SR 80	HCM	1350	1420		HCM	0.92	0.85	

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	James Ranch Road	0.47	0.53	None	0	1.000	0.90
2	SR 80	0.47	0.53	None	0	1.000	0.90
3	James Ranch Road	0.00	1.00	None	0	1.000	0.80
4	SR 80	0.47	0.53	None	0	1.000	0.85

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	James Ranch Road	0	1.000	24.0	1.00
2	SR 80	0	1.000	20.0	1.00
3	James Ranch Road	0	1.000	2.0	1.00
4	SR 80	0	1.000	17.0	1.00

Traffic Flow Data (veh/hr)

2050 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	James Ranch Road	0	185	10	1091	0	24.0	1.00	0.900
2	SR 80	0	355	374	10	0	20.0	1.00	0.900
3	James Ranch Road	0	10	10	10	0	2.0	1.00	0.800
4	SR 80	0	10	465	78	0	17.0	1.00	0.850

Operational Results

HCM 2016 - 2050 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	James Ranch Road	604	682		485		614	672		0.983	1.014	
2	SR 80	347	392		205		847	907		0.410	0.432	
3	James Ranch Road		30		914			517			0.058	
4	SR 80	260	293		375		727	789		0.358	0.371	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	James Ranch Road	98.4	122.8		111.4	27.6	34.5		F	F		F
2	SR 80	9.2	9.1		9.2	2.1	2.3		A	A		A
3	James Ranch Road		7.7		7.7		0.2			A		A
4	SR 80	9.5	9.1		9.3	1.7	1.8		A	A		A

Global Results

Performance and Accidents

2050 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	2608		2608
Capacity	veh/hr	5168		7909
Average Delay	sec/veh	118.35		118.35
L.O.S. (Signal)	A – F	F		F
L.O.S. (Unsig)	A – F	F		F
Total Delay	veh.hrs	85.74		85.74

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	79	205	136	75	45
Future Volume (veh/h)	32	79	205	136	75	45
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	43	105	223	148	88	56
Peak Hour Factor	0.75	0.75	0.92	0.92	0.85	0.80
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	583	1244	1244	555	245	218
Arrive On Green	0.38	0.38	0.38	0.38	0.15	0.15
Sat Flow, veh/h	939	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	43	105	223	148	88	56
Grp Sat Flow(s),veh/h/ln	939	1650	1650	1472	1654	1472
Q Serve(g_s), s	0.9	0.5	1.2	1.8	1.3	0.9
Cycle Q Clear(g_c), s	2.0	0.5	1.2	1.8	1.3	0.9
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	583	1244	1244	555	245	218
V/C Ratio(X)	0.07	0.08	0.18	0.27	0.36	0.26
Avail Cap(c_a), veh/h	2354	7466	7466	3330	1559	1387
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.2	5.3	5.5	5.7	10.2	10.0
Incr Delay (d2), s/veh	0.2	0.1	0.2	0.9	0.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.1	0.1	0.2	0.4	0.5	0.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.4	5.4	5.8	6.6	10.5	10.2
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		148	371		144	
Approach Delay, s/veh		5.7	6.1		10.4	
Approach LOS		A	A		B	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		16.1		10.4		16.1
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		4.0		3.3		3.8
Green Ext Time (p_c), s		2.2		0.1		5.4

Intersection Summary		
HCM 6th Ctrl Delay		7.0
HCM 6th LOS		A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	76	191	158	105	85	51
Future Volume (veh/h)	76	191	158	105	85	51
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	101	255	172	114	100	64
Peak Hour Factor	0.75	0.75	0.92	0.92	0.85	0.80
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	618	1269	1269	566	258	230
Arrive On Green	0.38	0.38	0.38	0.38	0.16	0.16
Sat Flow, veh/h	1015	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	101	255	172	114	100	64
Grp Sat Flow(s),veh/h/ln	1015	1650	1650	1472	1654	1472
Q Serve(g_s), s	2.0	1.4	0.9	1.4	1.5	1.1
Cycle Q Clear(g_c), s	2.9	1.4	0.9	1.4	1.5	1.1
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	618	1269	1269	566	258	230
V/C Ratio(X)	0.16	0.20	0.14	0.20	0.39	0.28
Avail Cap(c_a), veh/h	2450	7222	7222	3221	1508	1342
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.4	5.6	5.5	5.6	10.4	10.2
Incr Delay (d2), s/veh	0.4	0.3	0.2	0.6	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	0.3	0.2	0.3	0.6	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.9	5.9	5.7	6.3	10.7	10.4
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		356	286		164	
Approach Delay, s/veh		6.2	5.9		10.6	
Approach LOS		A	A		B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		16.6		10.8		16.6
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		4.9		3.5		3.4
Green Ext Time (p_c), s		5.6		0.1		4.1
Intersection Summary						
HCM 6th Ctrl Delay			7.0			
HCM 6th LOS			A			
Notes						

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	36	89	230	154	84	50
Future Volume (veh/h)	36	89	230	154	84	50
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	45	111	271	181	99	62
Peak Hour Factor	0.80	0.80	0.85	0.85	0.85	0.80
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	556	1311	1311	585	253	225
Arrive On Green	0.40	0.40	0.40	0.40	0.15	0.15
Sat Flow, veh/h	872	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	45	111	271	181	99	62
Grp Sat Flow(s),veh/h/ln	872	1650	1650	1472	1654	1472
Q Serve(g_s), s	1.0	0.6	1.5	2.4	1.5	1.0
Cycle Q Clear(g_c), s	2.5	0.6	1.5	2.4	1.5	1.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	556	1311	1311	585	253	225
V/C Ratio(X)	0.08	0.08	0.21	0.31	0.39	0.28
Avail Cap(c_a), veh/h	2077	7069	7069	3153	1476	1314
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.4	5.3	5.5	5.8	10.7	10.5
Incr Delay (d2), s/veh	0.2	0.1	0.3	1.1	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.2	0.1	0.3	0.6	0.6	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.6	5.4	5.8	6.9	11.1	10.7
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		156	452		161	
Approach Delay, s/veh		5.7	6.3		10.9	
Approach LOS		A	A		B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		17.2		10.8		17.2
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		4.5		3.5		4.4
Green Ext Time (p_c), s		2.4		0.1		6.8
Intersection Summary						
HCM 6th Ctrl Delay			7.1			
HCM 6th LOS			A			
Notes						

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	86	215	178	118	95	57
Future Volume (veh/h)	86	215	178	118	95	57
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	101	253	209	139	112	71
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.80
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	591	1290	1290	575	268	239
Arrive On Green	0.39	0.39	0.39	0.39	0.16	0.16
Sat Flow, veh/h	959	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	101	253	209	139	112	71
Grp Sat Flow(s),veh/h/ln	959	1650	1650	1472	1654	1472
Q Serve(g_s), s	2.2	1.4	1.2	1.8	1.7	1.2
Cycle Q Clear(g_c), s	3.3	1.4	1.2	1.8	1.7	1.2
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	591	1290	1290	575	268	239
V/C Ratio(X)	0.17	0.20	0.16	0.24	0.42	0.30
Avail Cap(c_a), veh/h	2259	7028	7028	3134	1468	1306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.7	5.7	5.6	5.8	10.6	10.4
Incr Delay (d2), s/veh	0.5	0.3	0.2	0.8	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	0.3	0.2	0.4	0.7	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.2	5.9	5.8	6.6	11.0	10.6
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		354	348		183	
Approach Delay, s/veh		6.3	6.1		10.9	
Approach LOS		A	A		B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		17.1		11.1		17.1
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		5.3		3.7		3.8
Green Ext Time (p_c), s		5.7		0.1		5.0
Intersection Summary						
HCM 6th Ctrl Delay			7.2			
HCM 6th LOS			A			

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	138	356	237	130	78
Future Volume (veh/h)	55	138	356	237	130	78
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	69	172	419	279	153	92
Peak Hour Factor	0.80	0.80	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	494	1632	1632	728	253	225
Arrive On Green	0.49	0.49	0.49	0.49	0.15	0.15
Sat Flow, veh/h	694	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	69	172	419	279	153	92
Grp Sat Flow(s),veh/h/ln	694	1650	1650	1472	1654	1472
Q Serve(g_s), s	2.3	1.0	2.6	4.2	3.1	2.0
Cycle Q Clear(g_c), s	4.9	1.0	2.6	4.2	3.1	2.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	494	1632	1632	728	253	225
V/C Ratio(X)	0.14	0.11	0.26	0.38	0.60	0.41
Avail Cap(c_a), veh/h	1315	5536	5536	2469	1156	1029
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.7	4.8	5.2	5.6	14.1	13.7
Incr Delay (d2), s/veh	0.5	0.1	0.3	1.2	0.9	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	0.2	0.6	1.1	1.6	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.1	4.9	5.5	6.8	15.0	14.1
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		241	698		245	
Approach Delay, s/veh		5.5	6.1		14.7	
Approach LOS		A	A		B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		23.8		12.0		23.8
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		6.9		5.1		6.2
Green Ext Time (p_c), s		4.1		0.2		11.5
Intersection Summary						
HCM 6th Ctrl Delay			7.7			
HCM 6th LOS			A			
Notes						

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6
Movement	EBTL	SBL	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Min	None	Min
Maximum Split (s)	66.1	31.5	66.1
Maximum Split (%)	67.7%	32.3%	67.7%
Minimum Split (s)	24.1	24.5	24.1
Yellow Time (s)	5	4.3	5
All-Red Time (s)	1.1	2.2	1.1
Minimum Initial (s)	10	6	6
Vehicle Extension (s)	6	1.5	6
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	66.1	0
End Time (s)	66.1	0	66.1
Yield/Force Off (s)	60	91.1	60
Yield/Force Off 170(s)	60	91.1	60
Local Start Time (s)	0	66.1	0
Local Yield (s)	60	91.1	60
Local Yield 170(s)	60	91.1	60

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: SR 80 & US 191

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	133	332	275	183	147	88
Future Volume (veh/h)	133	332	275	183	147	88
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1737	1737	1737	1737	1737	1737
Adj Flow Rate, veh/h	156	391	324	215	173	104
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	11	11	11	11	11	11
Cap, veh/h	559	1671	1671	745	253	225
Arrive On Green	0.51	0.51	0.51	0.51	0.15	0.15
Sat Flow, veh/h	805	3387	3387	1472	1654	1472
Grp Volume(v), veh/h	156	391	324	215	173	104
Grp Sat Flow(s),veh/h/ln	805	1650	1650	1472	1654	1472
Q Serve(g_s), s	4.9	2.5	2.0	3.1	3.7	2.4
Cycle Q Clear(g_c), s	6.9	2.5	2.0	3.1	3.7	2.4
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	559	1671	1671	745	253	225
V/C Ratio(X)	0.28	0.23	0.19	0.29	0.68	0.46
Avail Cap(c_a), veh/h	1457	5355	5355	2389	1118	995
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	6.9	5.1	5.0	5.3	14.8	14.3
Incr Delay (d2), s/veh	1.0	0.3	0.2	0.8	1.2	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.8	0.5	0.4	0.8	1.9	1.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.8	5.4	5.2	6.0	16.0	14.8
LnGrp LOS	A	A	A	A	B	B
Approach Vol, veh/h		547	539		277	
Approach Delay, s/veh		6.1	5.5		15.6	
Approach LOS		A	A		B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		24.8		12.2		24.8
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1
Max Green Setting (Gmax), s		* 60		* 25		* 60
Max Q Clear Time (g_c+I1), s		8.9		5.7		5.1
Green Ext Time (p_c), s		9.9		0.2		8.3
Intersection Summary						
HCM 6th Ctrl Delay			7.8			
HCM 6th LOS			A			

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6	8
Movement	EBTL	SBTL	WBTL	NBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	Min	None	Min	None
Maximum Split (s)	66.1	31.5	66.1	31.5
Maximum Split (%)	67.7%	32.3%	67.7%	32.3%
Minimum Split (s)	24.1	24.5	24.1	24.5
Yellow Time (s)	5	4.3	5	4.3
All-Red Time (s)	1.1	2.2	1.1	2.2
Minimum Initial (s)	10	6	10	6
Vehicle Extension (s)	6	1.5	6	1.5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	66.1	0	66.1
End Time (s)	66.1	0	66.1	0
Yield/Force Off (s)	60	91.1	60	91.1
Yield/Force Off 170(s)	60	91.1	60	91.1
Local Start Time (s)	0	66.1	0	66.1
Local Yield (s)	60	91.1	60	91.1
Local Yield 170(s)	60	91.1	60	91.1

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	50

Splits and Phases: 2: US 191 & SR 80

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	88	134	65	6	393	118	49	36	4	55	47	103
Future Volume (veh/h)	88	134	65	6	393	118	49	36	4	55	47	103
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1189	1663	1870	1870	1663	1737	1870	1870	1870	1500	1870	1485
Adj Flow Rate, veh/h	104	168	81	8	462	139	61	45	5	69	55	121
Peak Hour Factor	0.85	0.80	0.80	0.80	0.85	0.85	0.80	0.80	0.80	0.80	0.85	0.85
Percent Heavy Veh, %	48	16	2	2	16	11	2	2	2	27	2	28
Cap, veh/h	389	1492	748	691	1492	695	311	322	36	377	101	223
Arrive On Green	0.47	0.47	0.47	0.47	0.47	0.47	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	520	3159	1585	1131	3159	1472	1209	1654	184	1087	520	1144
Grp Volume(v), veh/h	104	168	81	8	462	139	61	0	50	69	0	176
Grp Sat Flow(s),veh/h/ln	520	1580	1585	1131	1580	1472	1209	0	1837	1087	0	1664
Q Serve(g_s), s	5.8	1.1	1.1	0.2	3.4	2.1	1.8	0.0	0.9	2.1	0.0	3.6
Cycle Q Clear(g_c), s	9.3	1.1	1.1	1.3	3.4	2.1	5.4	0.0	0.9	3.0	0.0	3.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.10	1.00		0.69
Lane Grp Cap(c), veh/h	389	1492	748	691	1492	695	311	0	358	377	0	324
V/C Ratio(X)	0.27	0.11	0.11	0.01	0.31	0.20	0.20	0.00	0.14	0.18	0.00	0.54
Avail Cap(c_a), veh/h	968	5011	2514	1950	5011	2335	874	0	1214	884	0	1100
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.0	5.6	5.6	5.9	6.2	5.8	16.2	0.0	12.6	13.8	0.0	13.7
Incr Delay (d2), s/veh	1.3	0.1	0.2	0.0	0.4	0.5	0.1	0.0	0.1	0.1	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.8	0.3	0.3	0.0	0.9	0.6	0.7	0.0	0.5	0.7	0.0	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.4	5.7	5.8	5.9	6.6	6.3	16.3	0.0	12.7	13.9	0.0	14.2
LnGrp LOS	B	A	A	A	A	A	B	A	B	B	A	B
Approach Vol, veh/h		353			609			111			245	
Approach Delay, s/veh		7.1			6.5			14.6			14.2	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		24.0		13.9		24.0		13.9				
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1		* 6.5				
Max Green Setting (Gmax), s		* 60		* 25		* 60		* 25				
Max Q Clear Time (g_c+I1), s		11.3		5.6		5.4		7.4				
Green Ext Time (p_c), s		6.6		0.5		10.2		0.1				

Intersection Summary			
HCM 6th Ctrl Delay			8.8
HCM 6th LOS			A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	2	4	6	8
Movement	EBTL	SBTL	WBTL	NBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	Min	None	Min	None
Maximum Split (s)	66.1	31.5	66.1	31.5
Maximum Split (%)	67.7%	32.3%	67.7%	32.3%
Minimum Split (s)	24.1	24.5	24.1	24.5
Yellow Time (s)	5	4.3	5	4.3
All-Red Time (s)	1.1	2.2	1.1	2.2
Minimum Initial (s)	10	6	10	6
Vehicle Extension (s)	6	1.5	6	1.5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	66.1	0	66.1
End Time (s)	66.1	0	66.1	0
Yield/Force Off (s)	60	91.1	60	91.1
Yield/Force Off 170(s)	60	91.1	60	91.1
Local Start Time (s)	0	66.1	0	66.1
Local Yield (s)	60	91.1	60	91.1
Local Yield 170(s)	60	91.1	60	91.1

Intersection Summary	
Cycle Length	97.6
Control Type	Actuated-Uncoordinated
Natural Cycle	55

Splits and Phases: 2: US 191 & SR 80

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	166	370	113	10	212	82	51	37	5	32	82	87
Future Volume (veh/h)	166	370	113	10	212	82	51	37	5	32	82	87
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1426	1663	1870	1870	1693	1737	1870	1870	1870	1530	1870	1485
Adj Flow Rate, veh/h	195	435	133	12	249	96	64	46	6	40	96	102
Peak Hour Factor	0.85	0.85	0.85	0.80	0.85	0.85	0.80	0.80	0.80	0.80	0.85	0.85
Percent Heavy Veh, %	32	16	2	2	14	11	2	2	2	25	2	28
Cap, veh/h	543	1694	850	592	1724	789	264	324	42	346	166	176
Arrive On Green	0.54	0.54	0.54	0.54	0.54	0.54	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	790	3159	1585	954	3216	1472	1185	1621	211	1106	830	882
Grp Volume(v), veh/h	195	435	133	12	249	96	64	0	52	40	0	198
Grp Sat Flow(s),veh/h/ln	790	1580	1585	954	1608	1472	1185	0	1832	1106	0	1712
Q Serve(g_s), s	7.9	3.5	2.0	0.3	1.9	1.5	2.5	0.0	1.1	1.5	0.0	5.0
Cycle Q Clear(g_c), s	9.7	3.5	2.0	3.9	1.9	1.5	7.5	0.0	1.1	2.6	0.0	5.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.12	1.00		0.52
Lane Grp Cap(c), veh/h	543	1694	850	592	1724	789	264	0	366	346	0	342
V/C Ratio(X)	0.36	0.26	0.16	0.02	0.14	0.12	0.24	0.00	0.14	0.12	0.00	0.58
Avail Cap(c_a), veh/h	1113	3973	1993	1279	4044	1851	648	0	960	705	0	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.0	6.0	5.6	7.0	5.6	5.5	20.7	0.0	15.7	16.8	0.0	17.3
Incr Delay (d2), s/veh	1.5	0.3	0.3	0.0	0.1	0.2	0.2	0.0	0.1	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.6	1.1	0.7	0.1	0.6	0.5	1.1	0.0	0.8	0.6	0.0	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.5	6.2	5.9	7.0	5.7	5.7	20.8	0.0	15.8	16.8	0.0	17.9
LnGrp LOS	A	A	A	A	A	A	C	A	B	B	A	B
Approach Vol, veh/h		763			357			116			238	
Approach Delay, s/veh		7.0			5.8			18.6			17.7	
Approach LOS		A			A			B			B	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		31.7		16.0		31.7		16.0				
Change Period (Y+Rc), s		* 6.1		* 6.5		* 6.1		* 6.5				
Max Green Setting (Gmax), s		* 60		* 25		* 60		* 25				
Max Q Clear Time (g_c+I1), s		11.7		7.0		5.9		9.5				
Green Ext Time (p_c), s		13.9		0.5		5.4		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			9.3
HCM 6th LOS			A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	1	2	4	5	6	8
Movement	WBL	EBTL	SBTL	EBL	WBTL	NBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	12	50	28	17	45	28
Maximum Split (%)	13.3%	55.6%	31.1%	18.9%	50.0%	31.1%
Minimum Split (s)	9.5	24.1	24.5	9.5	24.1	24.5
Yellow Time (s)	3.5	5	4.3	3.5	5	4.3
All-Red Time (s)	1	1.1	2.2	1	1.1	2.2
Minimum Initial (s)	5	10	6	5	10	6
Vehicle Extension (s)	3	6	1.5	3	6	1.5
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	12	62	0	17	62
End Time (s)	12	62	0	17	62	0
Yield/Force Off (s)	7.5	55.9	83.5	12.5	55.9	83.5
Yield/Force Off 170(s)	7.5	55.9	83.5	12.5	55.9	83.5
Local Start Time (s)	78	0	50	78	5	50
Local Yield (s)	85.5	43.9	71.5	0.5	43.9	71.5
Local Yield 170(s)	85.5	43.9	71.5	0.5	43.9	71.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	75

Splits and Phases: 2: US 191 & SR 80

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	162	402	100	9	987	182	76	55	7	80	73	222
Future Volume (veh/h)	162	402	100	9	987	182	76	55	7	80	73	222
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1307	1633	1870	1870	1648	1737	1870	1870	1870	1544	1870	1544
Adj Flow Rate, veh/h	191	473	118	11	1097	214	89	69	9	94	86	261
Peak Hour Factor	0.85	0.85	0.85	0.80	0.90	0.85	0.85	0.80	0.80	0.85	0.85	0.85
Percent Heavy Veh, %	40	18	2	2	17	11	2	2	2	24	2	24
Cap, veh/h	254	1637	836	471	1370	644	144	414	54	328	104	317
Arrive On Green	0.10	0.53	0.53	0.01	0.44	0.44	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	1245	3103	1585	1781	3131	1472	1034	1621	211	1091	408	1239
Grp Volume(v), veh/h	191	473	118	11	1097	214	89	0	78	94	0	347
Grp Sat Flow(s),veh/h/ln	1245	1552	1585	1781	1566	1472	1034	0	1832	1091	0	1647
Q Serve(g_s), s	6.6	7.1	3.2	0.3	25.5	8.0	4.8	0.0	2.8	6.2	0.0	16.7
Cycle Q Clear(g_c), s	6.6	7.1	3.2	0.3	25.5	8.0	21.5	0.0	2.8	9.0	0.0	16.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.12	1.00		0.75
Lane Grp Cap(c), veh/h	254	1637	836	471	1370	644	144	0	468	328	0	421
V/C Ratio(X)	0.75	0.29	0.14	0.02	0.80	0.33	0.62	0.00	0.17	0.29	0.00	0.82
Avail Cap(c_a), veh/h	310	1637	836	606	1448	681	144	0	468	328	0	421
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.2	11.1	10.1	12.8	20.5	15.6	40.5	0.0	24.3	27.8	0.0	29.5
Incr Delay (d2), s/veh	8.0	0.4	0.3	0.0	4.5	1.1	5.7	0.0	0.1	0.2	0.0	11.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.5	3.7	1.7	0.2	13.4	4.5	3.6	0.0	2.0	2.7	0.0	11.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.2	11.4	10.4	12.8	25.0	16.7	46.2	0.0	24.4	28.0	0.0	41.3
LnGrp LOS	C	B	B	B	C	B	D	A	C	C	A	D
Approach Vol, veh/h		782			1322			167			441	
Approach Delay, s/veh		14.6			23.5			36.0			38.5	
Approach LOS		B			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.6	50.5		28.0	13.2	42.9		28.0
Change Period (Y+Rc), s	4.5	* 6.1		* 6.5	4.5	* 6.1		* 6.5
Max Green Setting (Gmax), s	7.5	* 44		* 22	12.5	* 39		* 22
Max Q Clear Time (g_c+I1), s	2.3	9.1		18.7	8.6	27.5		23.5
Green Ext Time (p_c), s	0.0	9.0		0.4	0.2	9.3		0.0

Intersection Summary			
HCM 6th Ctrl Delay			24.2
HCM 6th LOS			C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Phase Number	1	2	4	5	6	8
Movement	WBL	EBTL	SBTL	EBL	WBTL	NBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	12	48	30	20	40	30
Maximum Split (%)	13.3%	53.3%	33.3%	22.2%	44.4%	33.3%
Minimum Split (s)	9.5	24.1	24.5	9.5	24.1	24.5
Yellow Time (s)	3.5	5	4.3	3.5	5	4.3
All-Red Time (s)	1	1.1	2.2	1	1.1	2.2
Minimum Initial (s)	5	10	6	5	10	6
Vehicle Extension (s)	3	6	1.5	3	6	1.5
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)						
Flash Dont Walk (s)						
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	12	60	0	20	60
End Time (s)	12	60	0	20	60	0
Yield/Force Off (s)	7.5	53.9	83.5	15.5	53.9	83.5
Yield/Force Off 170(s)	7.5	53.9	83.5	15.5	53.9	83.5
Local Start Time (s)	78	0	48	78	8	48
Local Yield (s)	85.5	41.9	71.5	3.5	41.9	71.5
Local Yield 170(s)	85.5	41.9	71.5	3.5	41.9	71.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 2: US 191 & SR 80

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	332	1050	174	16	478	126	78	57	7	44	127	157
Future Volume (veh/h)	332	1050	174	16	478	126	78	57	7	44	127	157
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1485	1633	1870	1870	1663	1737	1870	1870	1870	1559	1870	1530
Adj Flow Rate, veh/h	391	1167	205	20	562	148	92	71	9	55	149	185
Peak Hour Factor	0.85	0.90	0.85	0.80	0.85	0.85	0.85	0.80	0.80	0.80	0.85	0.85
Percent Heavy Veh, %	28	18	2	2	16	11	2	2	2	23	2	25
Cap, veh/h	455	1496	764	210	992	462	204	464	59	366	216	269
Arrive On Green	0.19	0.48	0.48	0.02	0.31	0.31	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	1414	3103	1585	1781	3159	1472	1046	1627	206	1099	759	942
Grp Volume(v), veh/h	391	1167	205	20	562	148	92	0	80	55	0	334
Grp Sat Flow(s),veh/h/ln	1414	1552	1585	1781	1580	1472	1046	0	1833	1099	0	1701
Q Serve(g_s), s	14.6	25.4	6.3	0.6	12.1	6.2	7.0	0.0	2.7	3.2	0.0	14.2
Cycle Q Clear(g_c), s	14.6	25.4	6.3	0.6	12.1	6.2	21.2	0.0	2.7	5.9	0.0	14.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.11	1.00		0.55
Lane Grp Cap(c), veh/h	455	1496	764	210	992	462	204	0	523	366	0	485
V/C Ratio(X)	0.86	0.78	0.27	0.10	0.57	0.32	0.45	0.00	0.15	0.15	0.00	0.69
Avail Cap(c_a), veh/h	455	1599	817	335	1317	614	208	0	530	370	0	491
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.4	17.5	12.5	19.0	23.3	21.3	35.3	0.0	21.7	23.9	0.0	25.9
Incr Delay (d2), s/veh	15.1	3.6	0.7	0.2	1.8	1.4	0.6	0.0	0.0	0.1	0.0	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	9.3	12.6	3.5	0.4	7.5	3.7	3.2	0.0	2.0	1.4	0.0	9.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.6	21.1	13.2	19.2	25.1	22.7	35.8	0.0	21.8	24.0	0.0	29.1
LnGrp LOS	C	C	B	B	C	C	D	A	C	C	A	C
Approach Vol, veh/h		1763			730			172			389	
Approach Delay, s/veh		22.3			24.5			29.3			28.4	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.3	45.3		29.7	20.0	31.6		29.7
Change Period (Y+Rc), s	4.5	* 6.1		* 6.5	4.5	* 6.1		* 6.5
Max Green Setting (Gmax), s	7.5	* 42		* 24	15.5	* 34		* 24
Max Q Clear Time (g_c+I1), s	2.6	27.4		16.2	16.6	14.1		23.2
Green Ext Time (p_c), s	0.0	11.8		0.6	0.0	8.5		0.0

Intersection Summary	
HCM 6th Ctrl Delay	24.0
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.